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# The Design of Plate Glass Polishing Machines

By F. W. Preston[1]

**This article is written by Dr. Preston at our request, to explain the principles underlying the mathematical theory given in his paper of the same title published recently (June, 1927), in the Journal of the Society of Glass Technology. We believe that it will interest our readers to have a less severely technical account of the fundamental ideas which should guide the scientific design of polishing machines, and that many who will find the mathematical treatment forbidding will follow with pleasure the non-mathematical account that follows. While it is, of course, not possible to design a machine from the following account alone, we believe it will serve a useful purpose to call attention to the waste and inefficiency in the industry which results from neglect of fundamental scientific principles.—*Editor.***

PART I

I AM glad to comply with the request of the Editor for a non-mathematical account of the theory of plate glass polishing machines: considerations of space make it necessary to condense scientific papers presented to the technical press (such as the journals of scientific societies) into the smallest possible compass, with the result that they sometimes make very heavy reading, and mathematical papers in particular tend to be compressed into a sequence of hieroglyphics. Such papers are the rock bottom of course on which scientific progress rests: they are the authoritative sources of information and the references to which experts have recourse when trying to decide what an author really means and thinks. But in this age of specialization it is perhaps incumbent on a writer not only to deposit a formal statement of his theories with the journals of the scientific societies, but also to explain those theories in more popular language for those who will make use of them in practical life, or who are concerned with or interested in the principles at stake.

It was so with the Theory of Relativity, which in its bare intellectual form is beyond most mathematicians and quite beyond the layman. But popular interest in so abstruse a subject has been extraordinary, and many excellent non-technical accounts have therefore been prepared for the delectation of the public. It is not possible, none the less, for the layman, who has studied the non-mathematical accounts, to decide the validity or otherwise of the mathematical Theory of Relativity.

In the same way this present account is not intended as a substitute for, or an alternative analysis of, the matters set forth in detail in my mathematical paper in the *Journal of the Society of Glass Technology*. It is intended simply to explain and amplify the story.

Up to the present there has not been published, so far as we know, any theory to govern the designs of polishing machines. In consequence it is not generally realized how inefficient the average polishing machine really is. Most of the existing machines just "grew" or were designed by machine shops without any knowledge of glass polishing requirements. The runner layouts in consequence seem adapted to assist the foundry in casting them or the machine shop in machining them, rather than to assist the glass worker to polish his glass efficiently.

There has been, however, one noteworthy exception, a consulting engineer in this country, who has designed runners rationally, and some attempts seem to have been made in France, although from such fragmentary documents as have come into my hands those attempts seem to have stopped short of a comprehensive statement of the problem. My own memoirs have been in circulation to some extent for several years, and a number of people, both in Europe and America, are now, or have been recently, engaged in improving, or trying to improve, the designs of polishing machines; but so far as I am aware all such designers are trying to use methods which amount to assuming that the contact of the felt with the glass is a square instead of a circle, and by this and other simplifications they introduce somewhat serious errors. Any such method, in spite of its simplifications and the errors thereby introduced, is better than leaving it to a machine shop to guess at a design or throw a machine

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together at random. But just as a first-rate photographic lens cannot be constructed without refined calculations, so a first-rate polishing machine cannot be designed without refined methods.

### Theory of the Polishing Process

What happens when glass is polished?

We begin with a "smooth" or "ground" surface, the surface left by fine sand, garnet, emery, or artificial abrasive, which is trapped between the glass surface and the iron "runner-bars" of the grinding machine. It is strange that a ground surface which is clearly rough, being a splintered glass surface, should be technically known as a "smooth"

SETTING GLASS IN PLASTER PRIOR TO GRINDING
(Movie Scene made at Standard Plate Glass Co.)

one. Yet such a surface does in fact feel smoother to the hand than a polished one. It has a peculiarly silky or *soapy* feeling, so that the French speak of it as the "savonage" or "soaping." Incidentally this expression has led to some queer patents being issued by the United States Patents Office to European inventors, the patents being sometimes granted on "Apparatus for Soaping Glass" when they should have read "for Smoothing Glass."

The nature of a ground or "smoothed" piece of glass is far more complicated than one might suppose at first sight. The "smooth" or surface roughness extends below the surface proper in the form of innumerable tiny fissures and crevasses, and into these fissures still tinier pieces of glass débris are wedged. The glass near the surface is thus in a state of tremendous strain, very close to the breaking point in fact, and this terrific strain causes other strains, much less severe, but very perceptible, throughout the whole body of the glass. Mr. F. Twyman, to whose insight the glass industry owes so much, was the first to report the existence of these strains (see the Proceedings of the Optical Convention of London, 1905, p. 78). Their character was examined by the present writer and the existence of the fissure complex demonstrated (see the Transactions of the Optical Society of London, Vol. 23, p. 141, 1921-22), and recent remarkable use has been made of it by Messrs. Spencer and Ott (see the *Journal of the American Ceramic Society*, June, 1927).

The business of polishing consists in removing this roughness or "smooth," together with most of the underlying fissure complex, and incidentally, in removing the associated strains. It is, as a rule, more difficult to break a well polished piece of glass than a piece of ground glass of the same size and shape.

The process by which a ground or smoothed surface is turned into a polished one has been the matter of a good deal of debate. Some contend that the ground surface is liquefied by the drag of the polisher and, as it were, smeared about like butter on bread. Others contend that polishing is really just an exceedingly fine grinding operation. The debate was started by the late Lord Rayleigh, and has been carried on largely in England and the results of many experiments are recorded principally in the *Transactions of the Optical Society of London*. There will be found useful papers by Lord Rayleigh, Sir George Beilby, Dr. J. W. French, and the present writer, while on this side of the Atlantic Dr. Elihu Thompson has taken a strong stand in favor of Herschell's views (*Transactions American Optical Society*).

It must be confessed that a good deal of mystery still surrounds the matter of polishing, but the rival theories are not important for our present purpose; it is enough for our present purpose that experiment has shown that a good deal of glass is completely removed in polishing; the glass is not merely buttered about over the surface, it is completely removed from the main body of glass and may be collected later from the polishers.

The amount so removed varies with the quality of the ground surface and with the excellence of polish desired. It can be measured by weighing the glass before and after polishing, or by optical methods. In general it amounts to something in the order of ten wave lengths of yellow light. A wave length is 1/50,000 of an inch, so that the amount of glass removed is around 1/5000 inch or two ten-thousandths of an inch. On a 36-foot glass polishing deck this means some 30 cubic inches of glass, or between two and three pounds weight of glass. Much of this is cemented among the rouge on the face of the polishing blocks, and in fact forms an appreciable fraction of the "rouge-cake."

Of course the amount of glass removed has always been determined on small specimens, so that the amount removed on a big deck may be considerably more or somewhat less than is here estimated.

Now in the grinding operation we remove perhaps 1/16 inch from the thickness of the glass—that is, 1/16 inch from each side. On a 36-foot deck this amounts to about 800 or 1,000 pounds of glass from each side. But the total power consumed in removing the 2 or 3 pounds by polishing is considerably more than the total power consumed in removing the 800 or 1,000 pounds by grinding. In other words the polishing operation is extraordinarily inefficient, considered merely as a process—a physical process. It can be shown that if the whole of the polishing power could be concentrated on the layer that is removed (without heating the rest of the glass) then this layer would be not only melted, but driven off in vapor at a very early stage of the game. There is something fundamentally wrong with the process of polishing.

It must be understood, then, that when I refer to the

efficiency or inefficiency of polishing *machines,* I am *not* referring to the inefficiency of the physical process of polishing. When I speak of the efficiency of a polishing machine I am comparing it with an "ideal" machine using the same rouge, the same felt, and the same physical process. The ideal machine is simply one that polishes all parts of the glass equally fast, whereas all actual machines polish faster in some parts than in others. In other words the *rate of polishing* is not uniform with actual machines, and it is the business of the designer to make the rate of polishing as uniform as possible all over the table or deck.

This is of course the sole subject under discussion in the paper in the *Journal of the Society of Glass Technology.*

Now when glass is once completely polished—that is, when we have once completely removed the last traces of the smooth—it cannot be made to appear any better by further rubbing with the polisher. The glass is polished and that is all it can be. But if the polisher is in good condition we can continue to remove glass by continuing to rub. At one time it was suspected that the glass toughened under the action of the polisher, and that after a time no more glass would come off. The writer, however, tested the matter very thoroughly, and was unable to detect any slowing down of the rate of glass removed after the glass had been polished, so to speak, twenty times over.

Hence it comes about that when we speak of the Rate of Polishing we mean the rate at which glass is being removed at a given spot. We might define it as the volume of glass in cubic inches that is removed from a square foot of surface in one minute, assuming that it does not vary from place to place over the square foot in question. If it does vary, then we have to define Rate of Polishing (at a particular point) as the amount that would be removed from a square foot in a minute if the whole of the square foot polished as fast as the point in question.

According to this definition the Rate of Polishing in a good modern plate glass machine is probably around 1/2000 of a cubic inch per square foot per minute. Twenty or thirty years ago it was about one-tenth of this.

Now as I have said, it takes power to polish glass away, a great deal of power in view of the inefficiency of the process. And, therefore, if some parts of the deck polish faster than others, we have to use up a great deal of power in "overpolishing" the rapid parts while we struggle to bring the slow parts to a satisfactory standard. By "overpolishing" we simply mean, continuing to remove glass from them by polishing when they are already as good-looking as they ever will be.

Since power costs money, it is very desirable to have a machine polishing as uniformly as possible. Such uniformity not only cuts out waste of power, however, but it shortens the polishing time, and what is also important, it reduces the polishing stresses and the breakage.

For the parts that polish fastest are the parts that get hottest. As they heat up they try to expand. But they may be surrounded by cold or cool glass which does not want to expand. Then the cold glass is thrown into tension, and is ready to break at slight provocation. It may be shown that a few degrees difference of temperature is sufficient in many cases to introduce a stress of 1,000 pounds per square inch.

Existing polishing machines are for the most part poor designs. That they are not poorer is due to the fact that the Survival of the Fittest has operated among them, and those that were worse have gone to the wall. New machines of recent date have frequently turned out to be worse than older ones, so that they, too, have to go through the same weeding out process. An examination of existing machines shows that in general their efficiencies (as compared with an ideal machine) are usually from 60 to 80 per cent. They are sometimes lower. Around 70 per cent is a common figure. That means that a 600 horsepower machine wastes nearly 200 horsepower. We may be conservative and estimate that such a machine wastes $2 an hour or $200 a week or $10,000 a year.

By scientific design efficiencies around 90 per cent or sometimes 95 per cent may be attained, which saves the greater part of this loss and increases production 20 or 25 per cent. It is probable that most of the machines in the country are capable of from 10 to 30 per cent increase in productivity.

(*Part II will appear in an early issue*)

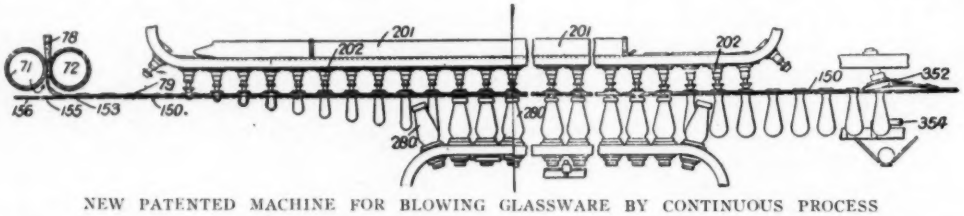
TRAMPING THE GLASS SHEETS INTO THE BED OF PLASTER TO FORCE OUT AIR BUBBLES
(Movie Scenes made at Standard Plate Glass Co.)

# Making Blown Bulbs By a Continuous Method

## Novel Process Greatly Increases Production Possibilities

From the British Patent Office in London there has issued a patent covering a revolutionary process for making blown glassware such as incandescent lamp bulbs and articles of similar shape. The method consists in forming a flowing stream of molten glass into a ribbon, depositing the ribbon on a horizontal conveyor formed with spaced apertures, and allowing part of the glass ribbon while still in a ductile state to sag through the apertures, the ribbon and molds being in continuous movement during the blowing operation.

The patent, No. 276,606 is in the name of R. Haddan, 31 Bedford Street, Strand, London, and was communicated by Corning Glass Works, Walnut Street, Corning, N. Y.




NEW PATENTED MACHINE FOR BLOWING GLASSWARE BY CONTINUOUS PROCESS

The successful development at Corning during the past year of a revolutionary continuous bulb making process has been known to comparatively few in the trade but among them intense interest has been manifested and conjecture indulged in as to the ultimate effect of the new process on the bulb making industry and other fields.

The product is said to be of superior quality, the walls of the bulbs being of uniform thickness throughout, resulting in greater strength and a better appearance, especially in the case of the inside frosted type, than that produced by the machines now in general use.

One report from a well informed source sets the production capacity of the machine at Corning at 250 ordinary bulbs per minute. It is said that the continuous process is also applicable to small bulbs.

It is understood that the entire development, which has been characterized as "another remarkable Corning achievement," was from the inventors' first hazy conception of the idea to the successful culmination of their efforts, the work of Corning organization alone, no assistance from outside having been required at any stage of the work.

In carrying out the invention described in the British patent, the molten glass flows in a continuous stream (78), from an aperture in a forehearth attached to a tank furnace, the rate of flow being controlled by a plug. The stream (78) passes between water-cooled rollers (71, 72), by which it is flattened into a ribbon (79). The ribbon is deposited on a continuously moving conveyer (150), consisting of a series of plates (153), carried by the links of an endless chain which moves in an horizontal plane. In an alternative construction, two sets of plates are carried by similar chains so arranged that pairs of plates come together end to end below the rolls (71, 72), and move forward as though they were single plates. Each plate is formed with an aperture (156), and as soon as the ribbon is deposited on the conveyer, the glass over the aperture commences to sag downward. The edges of the apertures limit the amount of glass which is available and also serve to anchor the ribbon on the conveyer. The travel of the conveyer brings the ribbon under the run of an endless chain of blow heads (202), which, during the lower part of their run, make contact with the underside of a blow box (201). The blow heads are pressed into contact with the glass ribbon above the apertures (156), and are supplied with air in regulated quantities from the blow box by means of valves or ports. The sagging glass expands progressively and each bulb so formed is enclosed in a mold (280). The apparatus is intended particularly for the production of electric lamp bulbs, although it can be adapted for the production of other kinds of ware. The molds (280), are carried by an endless chain moving in a vertical plane; they are provided with means for opening and closing them automatically. They are also provided with means for rotating them while they are closed in order that the finished ware may have a high finish and be free from mold marks. When a bulb is blown, the mold opens and moves downward, the blow heads are lifted and move upward, and the bulbs continue to move forward suspended from the conveyer. A disk (352), strips the glass ribbon from the plates of the conveyer and the bulbs are knocked off by an arm (354). An air blast is provided to cool the blow heads, and jets of water are sprayed on to the molds and conveyer plates during the inoperative parts of their run.

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### Huge Disk Successfully Made by New Process

The closing act in an interesting scientific drama that has lasted more than eight months was staged at the Bureau of Standards, Department of Commerce on January 21—the uncovering of a combined mold and annealing furnace containing a great disk of optical glass 70 inches in diameter, 11 inches thick and weighing about 3,500 pounds, poured at the plant last May. When the cover was removed in the presence of a small but distinguished group of scientific experts the glass was found to be practically perfect, and the long period of suspense for those responsible for the operation was over.

Such large disks of optical glass of the size required had never been made in this country and only twice abroad and the latter disks are said to be imperfect.

The disk will be used as a mirror for the new telescope of Perkins Observatory at Ohio Wesleyan University.

# Electrolytic Chromium Plating of Glass Molds and Cylinder Materials

By Dr. Kurt Illig[1]

Before the war, only a few steps had been taken to provide suitable protection from corrosion and oxidation of metals and articles manufactured therefrom, such as machinery and construction parts. But the lack of capital prevailing after the war in most of the civilized countries, as well as the necessity of utilizing available raw materials to the greatest advantage, caused effective protection from corrosion to become a center of interest. Investigations made by the Iron and Steel Institute on losses from corrosion of iron during the period of 1890 to 1923 show that 40 per cent of the world production of iron, amounting to a loss of about 700,000,000 tons, was destroyed by corrosion.

**CHROMIUM plating of glass molds leaves present manufacturing procedures undisturbed, provides molds with a protective coating, prevents surface corrosion, leaves the design sharp and greatly prolongs the life of the molds.**

Our present age is one of rationalization. This includes not only the simplification and cheapening of methods of production and standardization, but above all the use of an effective method of protection from corrosion.

It is necessary to distinguish between the protection of metal objects from either atmospheric, thermal, chemical or other corrosion, and from mechanical wear. Most of the agents generally used at present provide for more or less effective resistance to one of these corrosive influences. Considering the fact that the iron molds used by the glass industry, especially in the production of pressed and hollow glassware, are subjected to extreme heat, as well as to chemical corrosion from the fluid glass and to strong atmospheric influence, it is imperative to use a protective agent which will furnish resistance to thermal, chemical, and atmospheric influences.

Among the various materials to be considered for this purpose chromium predominates. Reference is made in this connection to nickel chrome iron. This alloy contains 7 per cent nickel and 20 per cent chromium, to which latter component its high capacity of resistance to corrosion may be chiefly attributed. No doubt the use of such steel as material for pressed glass molds would be the ideal way of solving the problem to meet all corrosive influences effectively, if it were not so hard that it is almost impossible to make molds from it. Preference should therefore be given to a process which makes it possible to employ the soft gray cast iron generally used for pressed glass molds, and to provide a hardening, protective coating on the fabricated mold making it resistant to thermal, chemical and atmospheric corrosion. Galvanic deposition of chromium is the best process existing at the present time.

Among recent publications about chromium plating the work of Sargent is of great importance. His experiments are the basis of nearly all of the present chromium plating processes. Sargent mentions an electrolyte containing 245 grams of chromic acid per liter, besides small quantities of chromium sulphate. His current density amounts to 1,000 amperes per square meter. Liebreich revived the problem of technical chromium plating and found that chromium plating furnishes the ideal protection from corrosion in many cases. The electrolyte mentioned by Liebreich is of completely different composition from the one developed by Sargent, and it was he who after Salzer first obtained patents.

The chromium plating itself is done in different ways and depends on the material to be protected, as well as on the kind of corrosion from which protection is desired. Besides furnishing protection from corrosion the chromium deposit, due to its extreme hardness, provides for an increased capacity of resistance of the basic metal to mechanical wear, such as friction, shocks and percussion.

The electrolyte has a content of 25 to 60 per cent chromic acid besides small portions of chromium of a lower degree of oxidation, such as chromic oxide. In many cases small additions to the electrolyte of other metal salts, such as copper sulphate, will improve results. Special care should be exercised to control the proper content of uncombined sulphuric acid in the solution.

The galvanic process is carried on in vessels which in smaller plants consist of earthenware. Iron vessels coated with a special kind of enamel or with an acid-proof layer, as well as wooden vats lined with lead sheeting, or aluminum vessels, may also be used. In America steel vessels are used.

The anodes are strips of lead which are hung into the solution; the objects to be chromium plated are attached to cathode bars. In order to plate articles of various sizes in the same solution, the electrolyzing vessel illustrated in Fig. 1 is provided with movable electrode bars. Special attention must be given to remove the vapors developed during the process, as chromic acid affects the mucous membrane of the nostrils and may even destroy the column of the nose.

Since the complete cathodic reduction of chromic acid consumes a considerable quantity of electricity, much higher current density and higher voltage are required than in the nickel plating process. The necessary current density varies between 200 and 10,000 amperes per square meter, depending on the metal to be treated; with a voltage of between 3 and 10 volts. Strong throwing power requires both high current density and high voltage.

From 15 to 25 per cent of the electric current is effective

[1] In *Glastechnische Berichte*, Vol. V., No. 6, 1927. Abstract of paper presented at the Sixth Meeting of the German Society of Glass Technology.

in terms of chromium, depending on low or high current density, as well as on the temperature of the solution. This comparatively low current efficiency results from the fact that considerable quantities of hydrogen are set free at the cathode. This hydrogen, carrying small drops of the solution with it, develops the disagreeable chromic acid vapors.

The temperature of the solution should be 20° Centigrade for dull deposits and 35° Centigrade for bright deposits. The time of exposure depends on the current density of the solution and on the desired thickness of the coating which in most cases will be a few thousandth of millimeters, but may amount up to 0.2 millimeters without any danger of a detaching of the deposit from the body.

Bright chromium deposits may be obtained on polished articles without any difficulty. It is essential in this case to use a solution temperature of 35° Centigrade. Heavy, dull deposits can be polished without difficulty.

The shape of the articles to be coated is of great importance for a uniform deposit, as the throwing power of galvanic chromium solutions into deep recesses is less effec-

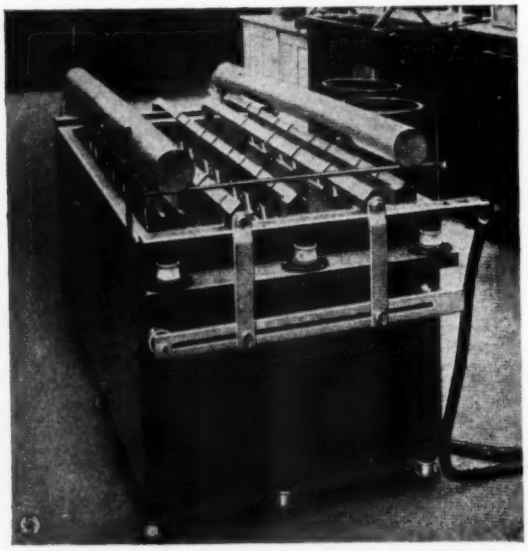


FIG. 1—CHROMIUM PLATING BATH OF EARTHENWARE, READY FOR OPERATION

tive than that of nickel solutions. This quality of the solution is less prominent with non-ferrous metal objects, but very striking with iron articles. The throwing power is the poorer, the more carboniferous the iron is. Figs. 2, 3 and 4 show several angles, characteristic of articles to be chromium plated. Figs. 2 and 3 show the effect of chromium plating on non-ferrous metals. In Fig. 2 the inside of the angles is chromium plated. Whereas a uniform deposit may be obtained on the obtuse angle, the right angle shows a slightly thinner coating in the point. The more acute the angle, the thinner the chromium deposits will be in the angular point, and in the case of angles of 45° the angular point will not be coated at all. Reverse conditions prevail if the outside surface is to be plated. The more acute the angle, the greater is the thickness of the chromium at the angular point. The easiest way to overcome this disproportion is to round the edges, as shown in both illustrations (2 and 3). However, it has recently been found that it is also possible to change the composition of the electrolyte, or to modify the electrolytic procedure without additional anodes, thus obtaining perfect chromium plating of objects with sharp rectangular or acute angular edges.

Fig. 4 illustrates the especially unfavorable conditions prevailing with gray iron, showing iron of different percentages of carbon content. The throwing capacity of the

FIG. 2—CHROMIUM DEPOSIT ON INSIDE ANGLES

solution on right angles of iron parts resembles that on right angles of brass objects if the iron does not contain more than 1/10 per cent of carbon. But with a carbon content of 1 per cent the inside of the angle will not be completely plated, and angles of cast iron parts containing more than 3 per cent of carbon will not accept any plating at all. Inasmuch as pressed glass molds always have angles of over 90°,—otherwise the glass could not be taken out of the mold after pressing—there should be no difficulty in chromium coating such molds.

It is possible at present to apply chromium plating to any article made from non-ferrous metal, regardless of its shape and contours, as well as on iron objects with a carbon

FIG. 3—CHROMIUM DEPOSIT ON OUTSIDE ANGLES

content of less than 1/10 per cent, if the proper method of operation is followed.

As mentioned previously, the carbon content as well as the silicon content of iron are of importance for its correct and uniform chromium plating. Articles made from such iron may be treated in the same solution with non-ferrous metal articles, as comparatively low current densities and low tension are required. Fig. 5 illustrates the polished surface of this kind of iron, enlarged 200 times. The white parts are ferrite, whereas the outlines of the crystals show pearlite. There is only little evidence of carbon which appears as dark spots. Iron containing 0.85 per cent of carbon does not offer any great difficulty to chromium plating, as long as there are no rectangular or acute-angled outlines, such as pictured in Fig. 4. This is not true of iron with a carbon content of more than 1 per cent. Cast iron, which is generally used by the pressed glass industry for the manufacture of molds, contains over 3 per cent of carbon. The higher the carbon content of the iron, the more difficult it is to chromium plate molds. Fig. 6 shows the polished surface of cast iron with a carbon content of 3.19 per cent—enlarged

300 times. The white particles are Ledeburite. The gray pearlite contains large, dark graphite needles. Fig. 7 represents the polished surface of a glass mold, enlarged 300 times. The numerous graphite needles, covering considerable surface, are here embedded in white ferrite particles, whereas the basic substance consists of pearlite. The analysis of this iron showed the following contents:

| | | |
|---|---|---|
| Carbon | 3.24 | per cent |
| Silicon | 2.06 | per cent |
| Sulphur | 0.104 | per cent |
| Phosphorus | 0.70 | per cent |
| Manganese | 0.51 | per cent |

This iron is very soft and may therefore be carved easily; this quality makes it specially fit for the manufacture of pressed glass molds. On the other hand, it is less suitable for chromium plating for the following reasons: Under normal conditions, that is, with comparatively low current densities of several hundred amperes per square meter, those parts of the iron surface which contain carbon decrease the potential of the solution to liberate hydrogen,

FIG. 4.—HOW INCREASE OF CARBON AFFECTS DEPOSITION OF CHROMIUM

thereby causing a strong development of hydrogen on these parts. This prevents the deposition of chromium on these parts, which deposition takes place on the other parts of the surface only. Even in case of long exposure to the solution the coating will be porous and will thus offer points of attack to corrosion in these porous parts. Corrosion will then spread out under the chromium deposit, which finally will detach. The opinion prevails at present that due to the decrease of the solution potential the carbon parts in the iron surface cannot reduce the chromic acid above the various lower degrees of oxidation to chrome metal, and for this reason it is impossible to obtain a chromium coating under normal operation of the plating process.

When experimenting with chromium deposition on highly graphitic iron, it was first hoped to overcome the difficulties by a preliminary galvanic copper deposit on the iron.

But as copper has a higher coefficient of expansion than iron and chromium, this latter quality caused the detaching of the copper deposit when exposed to heat. The copper deposit was therefore replaced by a nickel deposit, the coefficient of expansion of nickel being between that of iron and chromium. This process proved to be comparatively satisfactory and, in the meantime, has been patented. It was given up later on and was substituted by another procedure using much higher current densities. The latter procedure had been previously developed to a certain extent and was then brought to such perfection that it is now possible to obtain not only a completely uniform deposit which also covers the carbon parts of even the lowest quality of cast iron, but also excellent throwing power of the solution. In some cases this is done by using current densities of more than 10,000 amperes per square meter.

The way was thus prepared for successful chromium plating of glass molds. Fig. 8 shows several molds which have been chromium-plated. Deep molds are plated by means of an accessory anode which may be easily adjusted in the mold and by the use of which the electric current will reach the deepest parts, thus avoiding uneven deposits.

The outlines of the design on the mold will not become blunted by the chromium deposit, as the coating is compara-

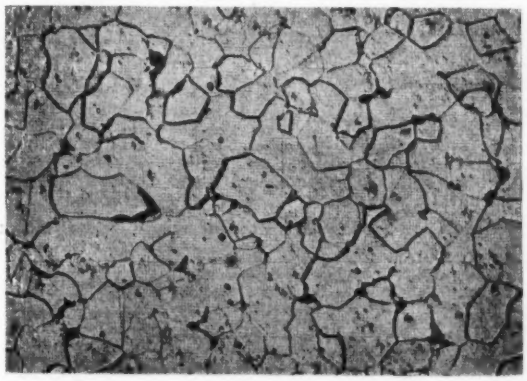


FIG. 5.—POLISHED THIN SECTION OF IRON WITH LESS THAN 0.1% C. WHITE FERRITE, AT CRYSTAL LIMITS: DARK PEARLITE.
(Enlarged 200 times)

tively thin, amounting to about 5 to 20 microns (thousandth of millimeter) and to 30 microns at the utmost. It is not advisable to apply thicker coating on cast iron molds, as the brittleness of chromium would then become evident.

As a preliminary condition for the success of chromium plating, it is essential to plate new molds only, as used molds

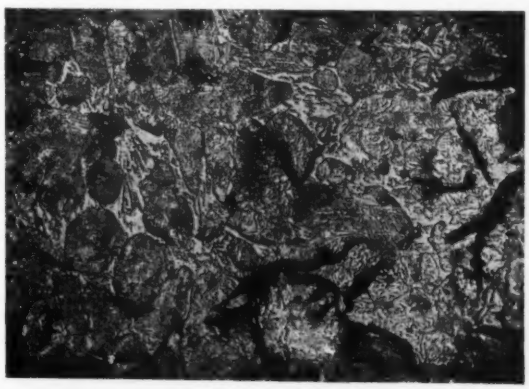


FIG. 6.—POLISHED THIN SECTION OF CAST IRON WITH 3.19% C, WHITE MATERIAL: LEDEBURITE, GRAY NEEDLES OF GRAPHITE IN PEARLITE.
(Enlarged 300 times)

have an oil coating which, when burnt in the chromium-plating process, would carbonize and thus make the iron even more carboniferous. In order to obtain bright deposits, the carved molds should first be carefully polished by means of steel brushes.

In summarizing the above, it can be stated that chromium plating affords the advantage of leaving the present manu-

facturing procedures for the production of molds, cylinders, etc., undisturbed and provides the ready-made articles with a protective chromium coating. A chromium deposit produced in a well equipped plant will prevent corrosion of the surface of the molds; the contours of the designs will remain sharp, the surface smooth, and the glass will thus detach completely when taken out of the mold. Frequent cleaning of the molds, which blunts the outlines, as well as re-carving, will be eliminated. This means considerable saving of wages, apart from the fact that a chromium plated mold will hold as long as several non-plated molds. In some cases more than 150,000 objects were pressed in the same mold, without any cleaning or re-carving; it was merely blown out and wiped off. The outlines were all of the same sharpness and had the same bright polish. Besides, chromium plating is very inexpensive. It takes between 5 and 15 minutes and the consumption of electric current may be as low as one kilowatt hour for a glass plate mold. The chromium deposit itself costs a few pennies. The price of an ordinary chromium plating plant lies between M.10,000 and

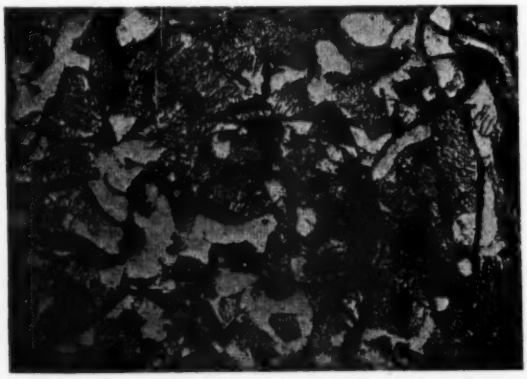


FIG. 7.—POLISHED THIN SECTION OF GLASS MOLD. GRAY NEEDLES OF GRAPHITE IN WHITE FIELD OF FERRITE. BACKGROUND: PEARLITE
(Enlarged 300 times)

M.15,000. The expenses for such a plant will be redeemed by a glass factory of medium size within one or two months.

In order to give a clear picture of the procedures followed in connection with chromium plating of pressed glass molds, it will be necessary to refer in detail to the physical and chemical reaction of the chromium deposit under high temperatures, as they are prevailing in the manufacture of pressed glass molds. It is known that in the cementation, meaning the treatment with heat of two or more closely connected metals, a diffusion of small portions of one metal into the other takes place quite frequently. In those cases both metals generally develop mixed crystals. If a chromium plated mold has been in use for some time, it will be found that due to the continuous heating through the fluid glass, the chromium deposit has diffused somewhat into the iron mold. There is thus formed a continuity of layers, starting with chromium on much chromium and a little iron; then much iron and a little chromium, and then down to the iron mold itself. This regularly occurring process causes a strong combination of iron and chromium and prevents the detaching of the deposit. After using the mold for a certain length of time, the thin chromium deposit will be entirely diffused into the iron surface, as the above-described reaction proceeds without interruption with the ever renewed strong influence from heat. As soon as there are found traces of exposed iron parts, it becomes necessary to subject the mold to a second chromium deposition to prevent corrosion of parts which have been decoated.

The fluid glass generally used in the pressed glass industry

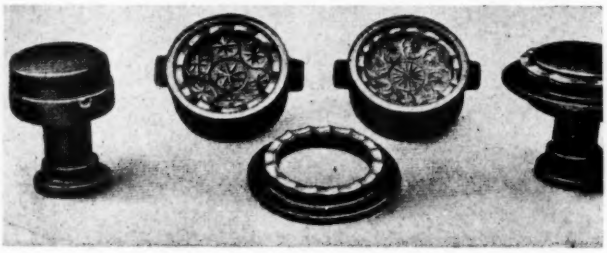


FIG. 8.—CHROMIUM PLATED MOLDS
(Siemens & Halske)

has a temperature of about 800° or over, but aways less than 1000° C., at the time of its pressure into the molds. At such temperatures the diffusion of chromium into the iron mold takes a long time; about 500 working hours will elapse before diffusion of a chromium deposit of from 5 to 10 microns into the iron will be noticeable. If the mold is exposed to higher temperatures, as for instance in the glass bottle industry using Owens machinery requiring about 1300° C., the diffusion of the chromium into the iron will take place much sooner, especialy at those parts of the mold which are most subjected to the heat. After a few days of operation, these parts will show traces of disappearance of the chromium deposit. It will therefore be necessary in these

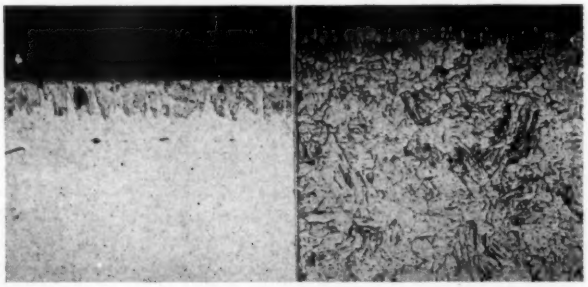


FIG. 9.—BORDER ZONE OF CHROMIUM PLATED TIN PLATE
(Enlarged 100 times)

FIG. 10.—STRUCTURE OF TIN PLATE AND CHROMIUM PLATING WITH WHICH IT IS GROWING TOGETHER
(Enlarged 100 times)

cases to repeat the chromium plating of the molds every few days; due to the short length of time and the low cost of the process, this will not inconvenience the general working system of the plant, especially when considering the saving through protection of the molds from corrosion. On the contrary: the continuous diffusion of the chromium into the iron, which gradually develops into chromium-iron alloy, will result in hardening the mold. Chromium resists temperatures up to 1500°, as its melting point is 1615°C.

Attempts are being made at present to develop a process which will combine both chromium deposition and cementation in one operation, using a procedure by which a fused

mass is operated electrolytically. It is impossible for the moment to predict the technical and economical advantage which may be yielded by this process; but results obtained up to the present are interesting enough to justify a few words regarding this matter.

Fig. 9 shows the surface of tin plate chromium plated

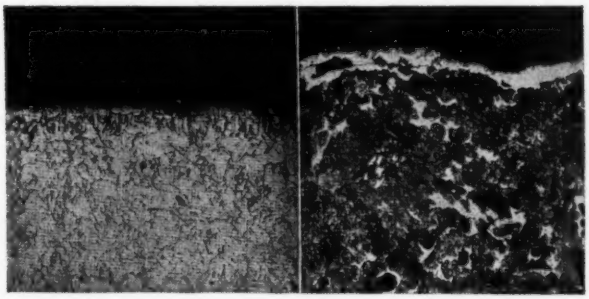


FIG. 11.—POLISHED THIN SECTION OF MATERIAL IN FIG. 10 AFTER ETCHING. BORDER PART SHOWS MIXED CRYSTALS.

FIG. 12.—POLISHED THIN SECTION OF CAST IRON, TREATED BY THE ELECTROLYTIC TEMPERING CHROMIUM PLATING PROCESS (Enlarged 100 times)

according to the new process (enlarged 100 times), demonstrating very clearly the way in which the chromium deposit combines with the tin plate. Fig. 10 also shows the strata of the tin plate (enlarged 100 times) and illustrates the strong unit of the two metals in an even better way. Fig. 11 is a photograph of the tin plate shown in Fig. 10, but shows the polished surtace after etching; besides the intergrown parts of chromium deposit and tin plate, the formation of mixed crystals may be seen on the surfaces of contact of both metals. As a matter of fact, the hardening effected by the new process is so intense that soft flexible tin plate strips were transformed into elastic hard material.

Fig. 12 illustrates the polished surface of a cast iron part treated with the electrolytic cementation-chromium plating process (enlarged 100 times). This iron is highly carboniferous. The white deposit to be seen in the picture consists of chromium. It is further shown in the picture that white particles of chromium are embedded even in the deep interior parts of the iron. Experiments have proved that this chromium has taken the place of carbon, previously found there. Due to the considerable hardening of the iron when treated by the new process—in some cases up to 9.5°, as compared with the hardness of the diamond of 10°—and judging from other experiments which are not yet completed, it may be assumed that the chromium surface and the carbon particles embedded in the iron develop chromium carbide which is known to be of extreme hardness. It may therefore be stated that the carbon content of the iron facilitates the entering of the chromium into the iron and into its deeper parts. It has been found when chromium plating cast iron according to the new process that chromium particles had grown into the iron as deep as several millimeters from the upper surface. It cannot be predicted at the present time to what extent this new procedure may obtain technical importance.

# Revised Circular on Ultraviolet Glass

## Bureau of Standards Letter on Ultraviolet Transmission of Various New Glasses and Window Glass Substitutes As Compared with That of Common Window Glass

This letter circular is issued in response to numerous inquiries for information on the transmissive properties of new glasses and organic substitutes for window glass for use in solariums, sun parlors, schools, homes, office buildings, animal houses, and green houses. [Issued January 14, 1928]

The visible rays of light are comprised between the approximate wave lengths of 760 mμ in the red and 400 mμ in the violet. Wave lengths longer than 760 mμ are called infra-red, and those shorter than 400 mμ, ultraviolet. Though the average eye is not sensitive to wave lengths shorter than 400 mμ such rays actually exist in the light of the sun, extending down to a wave length a little more or a little less than 300 mμ, depending on the time of day, season of year, latitude, altitude and clearness of atmosphere.

Since ordinary window glass shuts out the ultraviolet rays below about 310 mμ, much attention has been given of late to the production of special glasses, transparent to the shortest wave lengths which the atmosphere permits the sun to furnish us. This letter circular gives the results of ultraviolet transmission tests which have been made at the Bureau of Standards upon a number of such special glasses and common window glass.

### Total Transmission of Various Glasses for Those Ultra-Violet Solar Rays to Which Common Window Glass Is Opaque

Using a filter method, direct measurements with sunlight as source, have been made during the noon hours of especially clear days from April to December, 1927.

These measurements covered the solar spectral region to which common window glass is opaque (below about 310 mμ). Table 1 gives for that region the total transmission found for the following specimens:

*Table 1.* Total transmissions of various glasses, when new, for the ultra-violet solar rays to which common window glass is opaque.

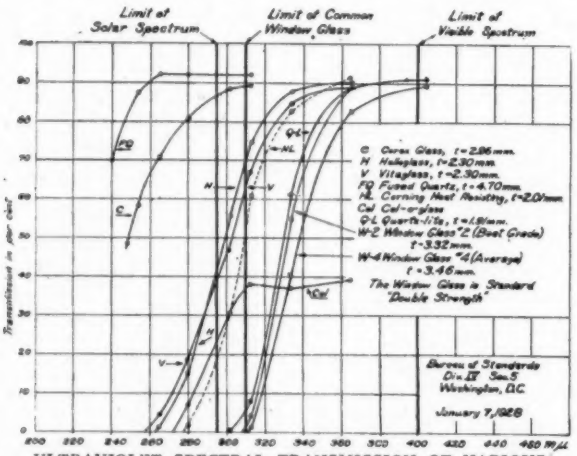
| *Trade Name* | *Per Cent Transmission* |
|---|---|
| Fused quartz | 92 |
| Corex | 92 |
| Helioglass (vioray[1]) | 50 |
| Vitaglass | 50 |
| Cel-o-glass[2] | 20 |
| Quartz-lite | 5 |
| Flexoglass[3] | 1 |
| Common window glass | 0 to 5 |

(1) Vioray is the foreign trade name for Helioglass.
(2) This consists of a fine wire screen whose interstices are covered with cellulose acetate.
(3) This is a loosely woven fabric usually covered with paraffin.

### Spectral Transmissions of Various Glasses for the Ultra-Violet Rays

A second and more reliable method of measuring the relative transparency of a specimen of glass to ultraviolet light is to determine its spectral transmission curve, wave length by wave length. Curves of this description are shown in the accompanying illustration. These curves were obtained by means of an artificial source of light (quartz mercury arc) giving a line spectrum richer in ultraviolet than the solar spectrum.

By means of these spectral transmission curves an estimate of the relative transmissions of the various specimens for rays shut out by common window glass, may be obtained by reading from the curves the values of the transmission at 302 mμ—the wave length of an intense mercury line, of convenient value for making such tests. Table 2 gives trans-


Limit of Solar Spectrum
Limit of Common Window Glass
Limit of Visible Spectrum
Transmission in per cent
C Corex Glass, t=2.86mm.
H Helioglass, t=2.30mm.
V Vitaglass, t=2.30mm.
FQ Fused Quartz, t=4.70mm.
NL Corning Heat Resisting, t=2.07mm
Cel Cel-o-glass
QL Quartz-lite, t=1.81mm.
W-2 Window Glass "2 (Best Grade) t=3.32mm.
W-4 Window Glass "4 (Average) t=3.46mm.
The Window Glass is Standard "Double Strength"
Bureau of Standards Div. II Sec. 5 Washington, D.C.
January 7, 1928
200 220 240 260 280 300 320 340 360 380 400 420 440 460 mμ
ULTRAVIOLET SPECTRAL TRANSMISSION OF VARIOUS WINDOW GLASSES WHEN NEW

mission values for this wave length. These are our most recent findings for new specimens.

*Table 2.* Per cent transmission of various glasses at 302 mμ when new.

| Trade Name | Number of Samples Tested | Average Thickness | Average Per Cent Transmission at 302 mμ |
|---|---|---|---|
| Fused quartz | 1 | 4.7 mm | 92 |
| Corex | 4 | 2.8 | 89 |
| Helioglass | 15 | 2.3 | 56 |
| Vitaglass | 15 | 2.5 | 44 |
| Cel-o-glass | 5 | .1 (about) | 30 |
| Quartz-lite | 16 | 1.9 | 0.5 |
| Common window glass | 14 | 3.3 | 0.0 |

### Solarization

Helioglass, Vitaglass and Cel-o-glass have been found to decrease in transmission at 302 mμ and neighboring wave lengths (295 to 310 mμ) by exposure to ultraviolet radiation from the sun, quartz mercury arc, and carbon arc. The rate of change is much more rapid with the arc than with the sun and varies also with the different glasses.

VITAGLASS has been on the market the longest, hence concerning this glass we are able to give the most information on solarization. A sample which had been in a hospital window in Rhode Island for a year was found to have a transmission of 25 per cent at 302 mμ (for thickness = 2.3 mm). Further exposure to the quartz mercury arc reduced the transmission but little, showing that solarization was complete.

Exposure in Washington of a sample (t = 2.35 mm) of Vitaglass directly to the sun for 123 hours (between 9 A.M. and 3 P.M. during June, July and August) decreased the transmission from 47 to 35 per cent. Our tests show that the greatest decrease in transmission occurs during the first few weeks' exposure. The average transmission of Vitaglass at 302 mμ after complete degeneration by the mercury arc is about 25 per cent for a thickness of 2.3 mm.

HELIOGLASS has not been on the market for a sufficient length of time to obtain a complete solarization test. Two samples each of Helioglass and Vitaglass, exposed simultaneously to the sun in October to December, were found to have decreased in transmission at about the same rate. The average transmission of Helioglass at 302 mμ, after complete degeneration by the mercury arc is about 30 per cent for a thickness of 2.3 mm.

COREX GLASS appears to undergo no appreciable change in transmission when exposed to solar radiation. For example, a sample of cathedral finish Corex which had been in a greenhouse roof in New York for 14 months was found to have, as nearly as could be measured on that kind of surface, the same transmission as a new sample. It was then polished plane and found to have a transmission of 89.5 per cent at 302 mμ, while the average transmission for new samples as given in Table 2, is 89.

On the other hand, exposure to a quartz mercury arc causes a very marked decrease in the transmission.

CEL-O-GLASS (cellulose acetate) becomes opaque at 302 mμ, and shorter wave lengths, after 25 hours' exposure to the quartz mercury arc. A sample that was exposed to the sun for 400 hours during the months of April to October, decreased but little in transparency at 302 mμ. On the other hand, samples that transmitted 30 per cent at 302 mμ, when new, transmitted only 5 to 10 per cent at this wave length after being exposed on the side of a building continuously day and night for 8 months, April to December, showing that the change in transparency may be owing to the varying conditions of the weather.

QUARTZ-LITE is not appreciably affected by sunlight. Exposure to the quartz mercury arc decreases its transmission slightly (measured at 313 mμ).

COMMON WINDOW GLASS is also slightly decreased in transmission by exposure to the quartz mercury arc but changes inappreciably in sunlight.

### Thickness

The thinner the glass, the greater in general will be its transparency to ultraviolet rays. Considerations of strength, however, set a limit to an indefinite reduction in thickness. Commercial samples have been submitted for test with a thickness of less than 1 mm (1/25 inch). In installing such glass, attention should be given to the proper size of sash to meet safety requirements.

---

### New Minerals Division

In order to provide the minerals and metals industry of the United States with economic facts of international significance, the Department of Commerce recently announced the creation of a new Minerals Division in the Bureau of Foreign and Domestic Commerce to supplement and assist in the work of the Economics Branch of the Bureau of Mines.

MAIN FACTORY BUILDINGS OF FABRICA MAZDA, RIO DE JANEIRO

# Fabrica Mazda

## A Modern Lamp Making Factory in Brazil

Brazil has added to its industries in recent years, the manufacture of incandescent lamps.

In 1921, there was set up in Rio de Janeiro, a lamp making factory known as Fabrica Mazda. Its product is distributed to the electrified sections of Brazil, and finds its way as well to neighboring countries.

THE PACKING ROOM

The plant is located on a plot of 57 acres about eight miles from the business center of Rio. It is equipped with modern lamp making machinery, and all its appointments and products are kept up to a high standard. The combined floor area is 60,000 square feet and the plant is producing close to three million lamps per year.

Fabrica Mazda is owned by General Electric S. A., and has the advantage of intimate contact with all the improvements taking place in the factories and laboratories of the General Electric Company in the United States. It can thus apply to its own production such methods as are appropriate for rendering effective service to the lamp users of Brazil.

In the factory where the bulbs are made, advantage is also taken of the glass making facilities to turn out shades and globes for lighting fixtures. Glassteel reflectors are used for this purpose, and the glass parts are of their own manufacture. It is said to be the best lighted factory in Brazil.

As the plant is somewhat remote from any thickly settled district, the company has provided upwards of 70 dwelling houses for which a very moderate rental charge is made.

DWELLING HOUSES FOR THE EMPLOYES

There is a schoolhouse on the factory grounds, sponsored by the company and attended by upwards of 100 children.

There is a dispensary with a nurse in constant attendance during factory working hours, a physician is always subject to call, and a local dentist is available twice a week. A cafeteria supplies the employes with an excellent lunch or "almoca" at a nominal expense, corresponding in United States money, to ten cents for men and boys and eight cents for girls. There is a private dining room reserved for executive heads and used also for gatherings, etc. An orchard of several hundred trees provides oranges, grape fruit, mangoes, and the like, tennis courts and recreation fields are made use of, and a successful football team upholds the laurels of the plant.

Abstract from *The Digest*, General Electric Company.

# Glass Industry

ESTABLISHED 1920

The First Trade Journal Devoted Primarily to Glass Technology, Engineering, Raw Materials, and Glass Factory Equipment and Operation

Published Monthly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CONTRIBUTIONS

THE EDITOR welcomes practical articles on all subjects related to GLASS MANUFACTURING. Such articles, if accepted, will be paid for at our usual rates.

THE GLASS INDUSTRY circulates extensively among American and foreign glass manufacturers, their business executives and technical and factory operating staffs.

Vol. 9 FEBRUARY, 1928 No. 2


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## Greater Competition Ahead

A study of the European situation impresses one with the fact that the ideas of standardization, simplification, reduction of waste, scientific management, economy of distribution, and so forth have taken a stronger hold in the glass industry of the principal European glass producing countries than ever before. Nor should this cause surprise on our part, as it means the adoption of policies which experience has proved to be effective and profitable for a number of years in this country.

At the beginning of January, this year the "Belgian Machine Glass Syndicate" went into operation. It includes ten window glass factories employing the Fourcault process. The syndicate was organized in June, 1927, but did not become fully effective since some of its members had not completed the installation of their machinery at the time of organization.

It is evident that the new organization will be to the Fourcault window glass producers what the "Commercial Union of Belgian Plate Glass Manufacturers" is to the Belgian plate glass industry, the latter including the leading plate glass producers located in the eastern part of Belgium.

While the United States, due to its high wage scale, has led the way in the means of increasing production and lowering of costs as enumerated above, foreign producers have resorted to combinations—the "Kartels" of Germany, the "Syndicates" of Belgium and France—which have the power of consolidation of corporations, the closing down of plants that are ineffective in operation, division of sales territories, regulation of prices, reduction or increasing producton with reference to demand, all of which activities are prohibited in this country by the anti-trust laws.

There cannot be any doubt that the new syndicate will prove to be a powerful factor in making Belgium an even stronger force in the window glass industry on the world market than is already the case. "The American window glass industry needs a Moses or a Mussolini." These words spoken at the meeting of window glass producers and distributors recently held in Pittsburgh aptly express the situation existing today. It is plain that some sort of readjustment must be made, as has already been obtained in other basic industries. The late Judge Gary and his associates in command of the steel industry have shown the way to a rational control of production with reference to consumption, which has made steel one of the most stable products of American industry. Other industries suffering from overproduction and lack of co-operation, notably the copper and oil industries, are looking towards organization for their salvation. To allow economic forces to act without restraint, and beyond the influence of reason is to invite disaster.

It is evident that the European manufacturer, having equally efficient methods of production, lower wage scale, lower costs of raw materials and the privilege of unlimited power of combination, is at a great advantage over the American producer. One way to meet existing conditions would be to obtain greater freedom to organize and combine than is now possible under existing laws. Another way would be the more effective use of trade associations.

If amendment of the anti-trust laws is not feasible, amelioration may yet be possible through the proper use of trade organizations within the present laws.

A step in the right direction was taken at the recent Pittsburgh meeting when producers and distributors discussed mutually the possibility of co-operating in the collection of production and market data, which would be of inestimable value to all branches of the window glass industry.

While foreign competition has a large share of the blame for conditions existing in the window glass business today, and granting that adequate tariff protection is urgently needed, the basic cause of the trouble is overproduction. The three processes working at the present time, the cylinder, Fourcault and Libbey-Owens processes are so effective that their production would further exceed the consumptive capacity of the country, were it not for the fact that a number of plants are closed down, or are only running with part of their equipment.

# Successful Meeting at Atlantic City Is Predicted

## Annual Meeting of Glass and Other Divisions of American Ceramic Society

Everything concerning the meeting of the American Ceramic Society, February 5 to 11, at the Hotel Ambassador, Atlantic City, indicates that it will be perhaps one of the largest and best in the history of the Society.

Hotel reservations for the period covered are reported to be heavier than usual. Exhibition space is in such demand that the committee has had to provide additional booths. It is hoped that as many individual glass men and other ceramists as possible will be present and as many concerns as possible interested in glass, refractories, ceramic arts, enamels, pottery, heavy clay products, terra cotta and white wares be represented.

The meeting will commence at the Hotel Ambassador on Sunday, February 5. Registration will be on that day and the reception will be held at four o'clock p.m.

An editorial in the January issue of the Society's *Journal* says:

"If one would benefit from the ideas of others who are manufacturing widely different ceramic products and who are not bound by traditions and long-time practices, he should attend the meetings of this Society. It is not an idealistic statement to say that he who would not be provincial in industrial processes should visit factories producing wholly different types of wares and hob-nob with those who have given study to the possible application to a specific product or process of the fundamentals, which are of analogous significance to a wide variety of industrial products and processes. There is a proved value in meeting with fellow ceramists and it is axiomatic that he who shuts himself in and shuts his industrial neighbors out is cheating himself out of the most effective way of making progress and of keeping abreast of the times.

"Come—stretch your mind! It will exhilarate you physically and mentally and send you back to your plant job with a broadened vision and increased facilities."

A half-fare concession on the certificate plan is being given by the railroads, the certificate to be obtained at point of departure when purchasing the one-way ticket to Atlantic City.

Many interesting papers will be presented. Some of general interest will be read at the General Session, including: Effect of Heat Treatment on Diatomaceous Earth, by H. M. Kraner; Thermal Properties, by W. Cohn; Possible Future Uses of Clays, by W. A. Koehler; Science vs. Engineering in the Schools, by A. F. Gorton; Effect of Heat on the Clay Minerals and Related Minerals and Related Compounds, by Herbert Insley and H. C. Stecker; Effect of Temperature on the Optical Properties of Kaolinite, by T. N. McVay; Some Observations on the Dehydration and Firing Behavior of Clays, by R. F. Geller and W. H. Wadleigh.

### Glass Division Program

H. L. DIXON, *Chairman* A. N. FINN, *Secretary*
C. D. SPENCER, *Papers and Program*

MONDAY, 2:00 P. M.

1. Some Effects of Carefully Annealing Optical Glass.
   By L. W. Tilton, A. N. Finn, and A. Q. Tool, Bureau of Standards, Washington, D. C.
2. Note on Some Photo and Thermo-chemical Changes in Certain Glasses.
   By A. Q. Tool and R. Stair, Bureau of Standards, Washington, D. C.
3. Some Electrical Properties of Glass for Electric Lighting and Discharge Devices.
   By Henry J. Miller, Nela Research Laboratory, General Electric Co., Cleveland, Ohio.
4. Indestructible Colors for Glass.
   By C. C. Leigh, General Color Products Co., Chicago, Illinois.

TUESDAY, 9:30 A. M.

5. Comparative Service of Refractory Blocks in Small Experimental Glass Tank.
   By R. F. Geller, W. L. Pendergast, and Herbert Insley, Bureau of Standards, Washington, D. C.
6. New Method for Producing Refractories for the Metal and Glass Industries.
   By Henry J. Miller, Nela Park, Cleveland, Ohio.
7. Properties of Cast Refractory Blocks and Suggestions for Installation in Glass Tanks.
   By G. S. Fulcher, Corning Glass Works, Corning, N. Y.
8. Report on New Plant of Corhart Refractories Co.
   By F. W. Schroeder, Louisville, Ky.

TUESDAY, 2:00 P. M.

9. Determination of Iron in Glass Sand. (Preprinted.)
   By G. E. F. Lundell and H. B. Knowles, Bureau of Standards, Washington, D. C.
10. Faraday's Researches in Connection with Glass Making.
    By E. W. Washburn, Bureau of Standards, Washington, D. C.
11. Old American Alabaster Glass.
    By Alexander Silverman, University of Pittsburgh, Pittsburgh, Pa.
12. Influence of History of Glass on Its Physical Properties.
    By Fritz Eckert, Technischen, Hochschule, Berlin.

WEDNESDAY, 9:30 A. M.

13. Life and Work of E. D. Libbey and M. J. Owens.
    By W. S. Walbridge and James Morrison, The Owens Bottle Co., Toledo, Ohio.
14. Commodore Richardson.
    By Henry W. Hess, The Richardson Co., Toledo, Ohio.
15. Glass Industry in Japan.
    By K. Fuwa, Tokyo Electric Co., Tokyo, Japan.
16. Glass Manufacture in Brazil.
    By H. Haynes, Fabrica Mazda, Rio de Janeiro, Brazil.
17. Business Session.

### Plant Trips

J. M. Gilfillan, manager of the Trumbull Electric Manufacturing Company, Pottery Division, Trenton, N. J., is general chairman of the Plant Trip Committee. H. L. Dixon, chairman of the Glass Division has appointed Herman K. Kimble, of the Kimble Glass Company, Vineland, N. J., and Lester M. Moss of the Harrison Bulb Works, Harrison, N. J., to assist him in arranging for visitations to various plants in New Jersey during the latter part of the week after the meetings of the society are over.

### Refractories Division

A Review of the Literature on Laboratory Slag Tests for Refractories, by Robert F. Ferguson.

Modern Glasshouse Refractories, by S. R. Scholes.

Thermochemical Relations of Mullite Refractories, by Harley C. Lee.

Winning of Missouri Diaspor, by C. R. Forbes.

Degree of Firing As It Affects Spalling, by H. D. Barger.

Variations in Softening Points of Refractory Mortars Caused by Method of Preparation, by Sanford S. Cole.

Cyanite As Found in Western North Carolina, by A. H. Fessler.

Details of Kiln Construction, by C. F. Geiger.

Laboratory Slag-Testing Furnace, by R. K. Hursh and C. E. Grigsby.

Some Effects of Coal Ash Slag on Refractories, by R. K. Hursh and T. N. McVay.

Prevention of the Disintegration of Blast Furnace Linings, by H. K. Mitra and Alexander Silverman.

Effect of Thermal Shock on Transverse Strength of Fireclay Brick, by C. W. Parmelee and A. E. R. Westman.

Refractories for Water-Cooled Boiler Furnaces, by L. V. Reese.

Refractories in Powdered Coal-Fired Furnaces, by L. V. Reese.

Laboratory for Technical Control of Manufacture of Refractories, by S. T. Trostel.

Effect of Reducing Agents on the Transverse Strength of Fireclay Brick, by A. E. R. Westman.

Discussions.—Proposed by L. C. Hewitt, Laclede Christy Clay Products Co., St. Louis, Mo.

1. Refractories to Resist Action of High Boric Acid Glasses. —A. Silverman.
2. Heat Conductivity of Refractories.—R. F. Geller.
3. Refractory Tests.
4. Plant Problems.
5. Refractories Utility Chart.
6. Checker Brick.
7. Control of Production in Fire Brick Plant.
8. Practical Success of Mullite Refractories in Glass Manufacture.
9. Testing Fire Brick for Resistance to Erosion.
10. Factors Affecting the Expansion of Fire Brick.
11. Methods Employed for Preventing Segregation of Ground Clay or Grog in Storage Bins.
12. Relative Costs of Firing Refractories in Periodic and Tunnel Kilns.
13. Methods of Calcining Fireclay.
14. Use of Hot Water in Tempering Clay Mixes.
15. Data on Air Cooling of Fireclay Walls.
16. Refractory Insulating Brick.
17. Refractory Cements.
18. Mullite Refractories.
19. Insulation of Kilns.

A few of the Art Division papers are:

Crystal Glazes, by W. W. Wilkins.

Architect and Artist Collaborate, by E. H. Putnam.

Consumer's Demands, by Evelyn T. Oppenheim.

Beautifying Glass, by Harold Nash.

Coöperation Between Artists and Manufacturers, by Edmund de F. Curtis.

Copper Red and Associated Colors in Controlled Palette of Colors, by Paul E. Cox.

Problems of Good Design in Tableware, by Charles F. Binns and Marion L. Fosdick.

The ENAMELS, HEAVY CLAY PRODUCTS, TERRA COTTA and WHITE WARES DIVISIONS are all well provided for, with papers by well-known men in their respective fields.

### European Trip Begins May 19

Those who contemplate taking the European tour of the American Ceramic Society in the spring are advised by the Society officers to make their decision as soon as possible and arrange for reservations on the steamship *Tuscania*, a 17,000-ton, one-class cabin steamer, sailing from New York, May 19, as the demand for space is rapidly increasing. An outline of the tour has been issued in pamphlet form by the American Ceramic Society, Inc., Tour Department, Suite 656, 25 Broadway, New York. The party will arrive at Paris, according to the schedule, on May 28.

The next three days of that week will be spent in Paris and vicinity, visiting ceramic factories, including the National Manufactory of Sèvres, and a trip to Versailles and other activities.

On Friday, June 1, there will be a choice of two trips. Those interested in glass will be given an opportunity to visit the plate glass works of the St. Gobain Company at Thourotte. The alternative trip will consist of visits to Essones and Fontainebleau, then the return will be made to Paris.

On June 3 the main party will cross the Rhine to Switzerland, visit Lake Lucerne, and climb the Rigi by the toothed railroad. On June 4 the refractory and glass sections will visit the glass factories at Nancy, under the auspices of the Master Glassmakers of France.

A full day will be devoted to visiting the points of interest at Munich on June 7, and on the 8th the party will again be divided, the refractory, heavy clay products and glass sections visiting factories in Prague, Czechoslovakia, and the rest of the party will go on to Carlsbad, then to Prague, to meet with the other sections on June 10, followed by a visit to Dresden on June 11.

The party will arrive in Berlin on June 15, where the Osram glass works will be visited. There will be a side trip to Aachen, in Frankfurt, by the refractory and glass sections, with a visit to the Glastechnische Gesellschaft and glass and refractory works in that vicinity on the 18th.

At Cologne, where the party will be on June 18, there will be a glass and refractory meeting.

Those remaining in Berlin, and then making the trip to Holland, will arrive in Amsterdam on Thursday, June 19, where sightseeing and other entertainment have been arranged for, including an official trip through the harbor and canals of Amsterdam. On June 20 a special train will take the party to The Hague.

Those going to England will arrive in London on June 21. Many points of historical interest, as well as glass and other ceramic factories, will be visited along the English route. The glass section of the party will make trips to Birmingham, Worcester, Stoke-on-Trent, and to the Department of Glass Technology, University of Sheffield.

On June 30 the party will sail for home on the *Tuscania*.

Much more detailed information concerning the entire tour, membership fee for the tour, etc., may be obtained from the Tour Department of the Society, Suite 656, 25 Broadway, New York.

### British Glass Technologists to Meet in Germany

At a meeting of the Society of Glass Technology held at Stourbridge, England, on November 23, Professor W. E. S. Turner announced that a definite decision had been reached concerning the meeting of the Society at Aachen (Aix la Chapelles), Germany, on May 22 to 24. It is expected that arrangements will be made for visiting some of the German glass factories.

### Breakage of Automobile Glass

According to W. F. Moore, of New York, who computes rates for plate glass insurance and compiles the statistics for plate glass insurance companies, the number of cars insured against breakage of plate glass is negligible as compared with the number of cars in use. On the basis of insured cars, however, the percentage of losses in 1926 was one plate in every 3.03 cars. The average cost per plate replaced during 1926 was $8.22. The loss frequency might be somewhat reduced with a greater number of cars insured.

## New Publications

TECHNOLOGY AND USES OF SILICA AND SAND, by J. M. Weigel. Bureau of Mines Bulletin No. 266. 210 page paper-covered volume. Price 40 cents. For sale by the Superintendent of Documents, Government Printing Office, Washington. Treats of the various forms of silica, quartz, quartzite, sandstone, and sand for all uses, tripoli, flint and chert, diatomaceous earth, the occurrence of deposits in the United States, prospecting and mining, preparation for the market, uses, markets and prices.

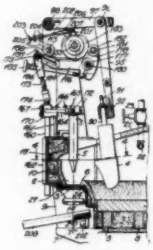
MANUFACTURE OF LIME. Circular No. 337, Bureau of Standards, Department of Commerce, Washington, D. C., superseding Technologic Paper No. 16. A 104-page publication containing a general discussion of the quality of stone used for lime making, and of burning, chemical and physical properties of lime and hydrated lime. The process and economy for the manufacturer of quicklime, heat utilization, efficiency and process of manufacture of hydrated lime, are treated at considerable length. In an appendix descriptions are given of typical lime manufacturing plants, including a number of concerns that specialize in the production of lime for glass-making purposes. The chemical industries used during 1925, about one and nine-tenths million tons of lime, including glass works 73,011 short tons, and silica brick, 25,901 short tons.

# Recent Patents

**NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT**

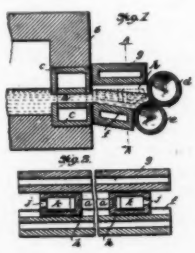
**Complete copies of U. S. Patent Specifications may be obtained from the Commissioner of Patents, Washington D. C. Price 10c each**

METHOD OF AND APPARATUS FOR FEEDING MOLTEN GLASS. U. S. 1,655,392. Jan. 3, 1928. Karl E. Peiler, West Hartford, Conn., assignor by mesne assignment to Hartford-Empire Co. Filed 5/5/19. Among the inventor's 78 claims is the method of separating molten glass in a container into mold charges, which consists in discharging the glass through a submerged outlet, periodically varying the depth of the glass over the outlet to vary the gravity discharge through the outlet, applying additional periodic impulses to the glass in the outlet in timed relation to the depth variations alternately to accelerate and retard the discharge, and severing successive mold charges from the discharged glass in timed relation to the depth variations.



BOTTLE-MAKING MACHINE. U. S. 1,653,723. Dec. 27, 1927. John J. Meyer, Jr., Glenshaw, Pa., and John G. Lepper, Decatur, Ill., assignors to Glenshaw Glass Co. Filed 11/7/17. In a bottle-making machine, the combination with a blank mold, of a blow mold arranged below the blank mold, said molds being movable in unison about a common center; a die in the base of the blank mold, and pneumatically operated means arranged at a point in the path of travel of said molds, for lifting said die through the arc of a circle from the blank mold, turning, opening said die to release the blank and returning the same to said blank mold base while the blank and blow molds are open and at rest.

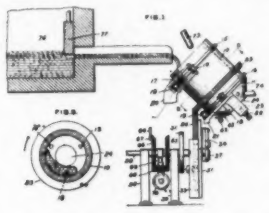
APPARATUS FOR FORMING SHEET GLASS. U. S. 1,654,784. Jan. 3, 1928. Louis Boudin, St. Gobain, France, assignor to Société Anonyme des Manufactures des Glaces & Produits Chimiques de Saint-Gobain. Filed 10/5/25. In the process for the manufacture of glass which embodies flowing the glass through a horizontal slot in the side wall of the furnace over and down an inclined weir by which it is delivered to rolls, difficulty has heretofore been experienced in that the upper surface of the glass moving on the weir has a different temperature from that of the bottom surface which is in contact with the weir. This invention covers the combination with a container having a flow slot therein; of rolls, a heating chamber intermediate of a slot and rolls, the bottom of the chamber forming a weir between the slot and rolls, and the side walls of the chamber being laterally adjustable to and from each other and a chamber interposed between the slot and the rollers and formed of blocks having internal cavities whereby they are heated, the side blocks of such chamber being laterally adjustable to and from each other.



GLASS TANK FURNACE. U. S. 1,652,608. Dec. 13, 1927. Charles L. Clark, Bridgeton, N. J. Filed 5/13/27. An object of the invention lies in the provision of pots which are constructed and placed directly in the working end or nose of the furnace, thus enabling the glass to be taken directly from said pots which are placed within the furnace, thus preventing the accumulation of cold or chilled glass and all impurities.

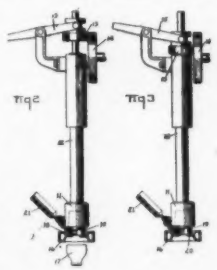
GLASS COMPOSITION. U. S. 1,652,259. Dec. 13, 1927. William C. Taylor, Corning, N. Y., assignor to Corning Glass Works. Filed 5/28/21. This application, which was filed as a division of a prior application, Serial No. 473,374, filed March 28, 1921, has for its purpose to protect the discovery that the addition of sulphates to a glass of relatively high silica content containing boric acid causes the glass, which would otherwise be transparent, to become translucent or semi-opaque, and this without the use of fluorides, phosphates, or alumina heretofore used for that purpose. It covers the process of making a clouded glass, comprising adding to a batch free from substantial quantities of lead and containing at least 3% boric oxide, a relatively high percentage of silica and only a relatively small percentage of alumina, an opacifying agent in the form of a sulphate salt and melting the mixture under conditions which do not result in a volatilization of the sulphur content.

METHOD AND APPARATUS FOR MELTING GLASS. U. S. 1,654,591. Jan. 3, 1928. Peter Kucera, Pittsburgh, Pa. Filed 2/21/23. The combination in a glass feeding mechanism, of a hollow inclined container having perforations adjacent one end thereof, means for feeding molten glass into the upper end of said container, means for controlling the temperature of the glass within said container, and means for intermittently rotating said container in one direction so as to periodically deliver suspended gobs of molten glass from different parts of the batch through said perforations.



SHEET-GLASS-ABRADING MEANS. U. S. 1,652,410. Dec. 13, 1927. Archie W. Platt, Toledo, O., assignor to the Edward Ford Plate Glass Co. Filed 11/18/26. A polishing roll, a receptacle for a polishing material mounted above and to one side of the roll axis and having a bottom discharge opening, a shaft extending through and supporting the receptacle for rocking movements and being parallel to the roll axis, agitating means mounted on the shaft within the receptacle, a distributing member carried by the receptacle and substantially closing the bottom opening thereof, said member being movable into engagement with the periphery of the roll by a rocking of the receptacle, and means for rocking the receptacle.

PROCESS OF MANUFACTURING GLASS. U. S. 1,654,817. Jan. 3, 1928. August Kadow, Toledo, O., assignor to Libbey Glass Manufacturing Co. Filed 11/16/23. In the manufacture of a blown glass article having an edge exposed during the normal use of the article, the process which consists in blowing an article with moil attached, removing the moil by melting the glass along the desired line of severance, fire-finishing the severed edge and forming a bead thereon while contacting it by gases only, heat treating the article so that all portions of it are at approximately the critical temperature when bead formation is completed, thereafter quickly raising the temperature of the article to high annealing heat, and finally cooling the article.



COMBINATION OF GLASS AND METAL BODIES. U. S. 1,649,907. Nov. 22, 1927. Robert F. Mayer, Vienna, Austria, assignor to the Limited Company W. C. Heraüs Gesellschaft Mit Beschrankter Haftung. Filed 4/6/21.

CHROMIUM PLATING. U. S. 1,645,927. Oct. 18, 1927. Harrie C. Pierce, Indianapolis, Ind., assignor to Metals Protection Corp. Filed 3/5/26. A process of plating a metal article with chromium in an electrolyte containing chromic acid, which consists in directing an electric current first through the article as an anode and then through the electrolyte to an electrode contacting with the

electrolyte, and then reversing the current flow so that it passes through said electrode and then through the electrolyte and the article to be plated, said article thus being made the cathode in the bath.

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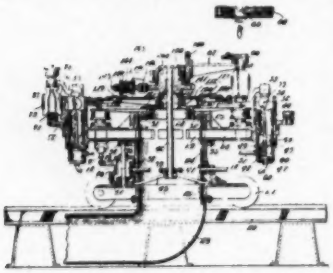
BOTTLE FORMING MACHINE. U. S. 1,648,792. Nov. 8, 1927. Albert F. Tremblay, Monterrey, Mexico (Three Rivers, Tex.). Filed June 26, 1926. A bottle forming machine comprising a pedestal, with a spider rotating thereon, means for rotating said spider, mold holding and transfer means carried by said spider, a head rotating independently of said spider on said pedestal, a funnel and mold plate carried by said head, a notched flange carried by the head, and a spring-pressed roller shiftable with the funnel and plate and engaging the notches in said flange.



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APPARATUS FOR HANDLING GLASSWARE. U. S. 1,654,091. Dec. 27, 1927. Karl E. Peiler, West Hartford, Conn., assignor to Hartford-Empire Co. Filed 3/3/23. In glassware-handling apparatus, the combination with a rotating ware holder, of a take-out device mounted to rotate about an axis spaced from that of said holder and adapted to move substantially in coincidence with the ware for a finite distance while approaching take-out position and arranged to engage and carry the ware from said holder.

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LEHR-HEATING MEANS. U. S. 1,653,042. Dec. 20, 1927. Enoch T. Ferngren, Toledo, O., assignor to the Libbey-Owens Sheet Glass Co. Filed 1/2/26. Has particular reference to a lehr for annealing a continuously moving sheet of glass, and having means for supporting a sheet therein, and electrical resistance units arranged above the sheet for causing the localized heating of the border portions thereof.

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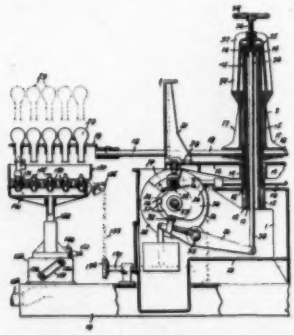
MACHINE FOR TREATING HOLLOW GLASS ARTICLES. U. S. 1,655,290. Jan. 3, 1928. Roscoe G. Phelps, Cleveland O., and Ludwig Staudenmeir, Cleveland Heights, O., assignors to General Electric Co. Filed 4/13/26. Particularly relates to machines for coating or frosting bulbs on the inside thereof, by method developed by Marvin Pipkin. The invention provides a movable rotating carrier having mounted thereon a number of holders, each adapted to receive and hold a glass article in a substantially vertical position. The carrier rotates, its movement being accomplished through a turret, shown in the drawing.



The intermittent drive for the turret comprises a continuously rotating disc 22 mounted upon a cam shaft 23, which is driven from an outside source such as a motor. By means of the carrier, each glass article during its travel around the machine is brought into operative relation to various devices in succession, and is held there stationary for a short time while each device automatically performs some operation on the said glass article. The bulbs are placed in the recesses with their open ends depending downward. As the carrier stops at each position, it is lowered so as to cause the open ends of the bulbs to register with pipes and other means which act upon the bulbs so as to properly frost or coat them on the inside. The raising and lowering of the carrier is accomplished by means of cam 30 which operates a lever 31 through a roller 32.

The bulbs are first washed inside, the carrier raised and rotated to the next position, where they are dried on absorbent drip pads and carried on to the first frosting station. The carrier is lowered so as to place the bulbs over a series of pipes and at the proper time air pressure is applied to force the frosting mixture into the bulbs. After the bulbs have been frosted, the carrier is raised to its rotating level and rotated, stopping for a short time at each of the next two positions, where the frosting mixture is again applied to the inside of the bulb. At the next station the bulbs receive a strengthening treatment by being subjected to a frosting mixture of lower degree than that used at the previous station.

The bulbs are again washed with water and are again frosted and treated at two more stations and again washed, after which they receive their final strengthening treatment and washing and are subjected to a stream of warm air blown through the pipes. In order to dry their neck portions, where a considerable amount of water or moisture has collected, a series of rotating driers is provided.

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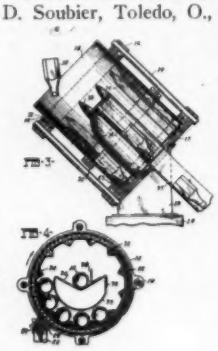
CONVEYING APPARATUS. U. S. 1,653,480. Dec. 20, 1927. Leonard D. Soubier, Toledo, O., assignor to the Owens Bottle Co. Filed 2/15/24. Means for receiving, distributing, transporting and discharging articles, comprising a hollow drum open at one end to receive the articles, a distributing member within the drum spaced therefrom and presenting a surface parallel with the inner surface of the drum to provide a passageway for the articles, means to rotate one of said parts about the axis of the drum while the other part remains stationary and provides a stationary guiding surface for the articles, and spaced ribs in said passageway and carried by said rotating part for positioning, spacing and driving said articles.



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WIRE-GLASS MACHINE. U. S. 1,656,583. Jan. 17, 1928. Joseph Hastreiter, Morgantown, W. Va. Filed 3/15/27. Brief description appeared in November, 1927, number of this journal.

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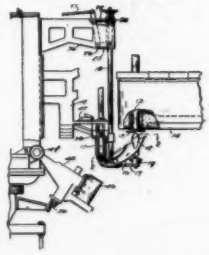
MEANS FOR CONVEYING MOLTEN GLASS TO MOLDS. U. S. 1,653,477. Dec. 20, 1927. Leonard D. Soubier, Toledo, O., assignor to the Owens Bottle Co. Filed 4/10/22. The combination of a mold open at its lower end, means for supplying individual severed charges of molten glass, means for conveying each charge en masse to and completely within the mold comprising a passageway extending downwardly and thence upwardly to the lower end of the mold, through which passageway the mass passes, and means to produce differential pressure on opposite sides of the charge of glass by which the latter is forced bodily upward into the mold through said open lower end of the mold.



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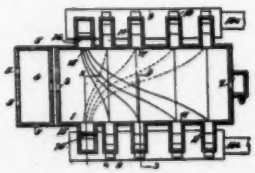
REGENERATIVE FURNACE FOR MELTING GLASS. U. S. 1,653,507. Dec. 20, 1927. Robert D. Pike, San Francisco, Cal., assignor to Cole-French Co. Filed 3/21/23. In this furnace there are a number of high velocity flames of high calorific intensity along the longer side of a glass tank furnace, and the products of combustion pursue a substantially diagonal course over the furnace hearth, a portion of them leaving the furnace through all or some of the fuel and air ports on the outgoing side, and the balance through a reversing valve situated on the longer side of the furnace on the far side of the fuel and air ports from the feed end of the furnace.



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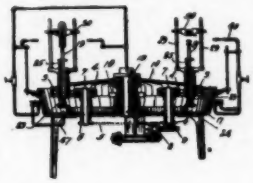
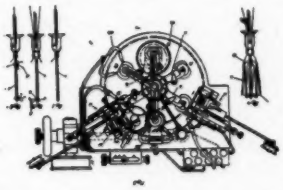
GLASS-CUTTING MACHINE. U. S. 1,649,282. Nov. 15, 1927. Charley J. Bishop, Cedar Falls, Iowa. Filed 3/2/26. A device adapted to receive and adjustably hold and clamp securely a plate of glass, whereby it may be cut by means of a glazier's

tool without displacement and along a line of a desired angularity relative to another of its edges.

SEALING-IN MACHINE FOR TUBES AND BULBS. U. S. 1,655,050. Jan. 3, 1928. Charles Eisler, Newark, N. J. Filed 4/25/25. A machine for sealing-in the stems of radio tubes and the like, including rotating heads of a novel construction and operation whereby the sealing-in, including the blowing off of the surplus fused bulb neck, is effected in an entirely automatic and improved manner as compared with prior mechanisms of this general character. A further object is a novel stem tube support, a mechanism including a novel single point support for the stem while being sealed into the bulb or tube whereby strains and breakages are substantially reduced. The automatic removal of the stem support, if desired, after the fusing takes place and before the setting without exerting pull on the plastic seal.



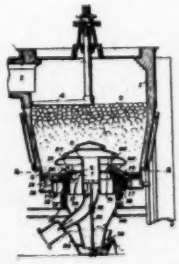
MACHINE FOR MAKING STEMS FOR INCANDESCENT LAMPS. U. S. 1,655,051. Jan. 3, 1928. Charles Eisler, Newark, N. J. Filed 7/1/26. The object generally is a machine whereby the forming of the hooks or supports and the insertion and spacing thereof in and about the stem arbors may be automatically and rapidly effected with a minimum of labor and attention. A particular object of the invention is a machine of this general character but readily adaptable at the will of the operator to the insertion of a variable number of hooks and supports properly spaced, depending upon the adjustments desired, the adjustment and shifting from one type of stem to another being readily effected and the proper number of hooks inserted without varying the speed of operation of the hook inserting device.



LAMINATED GLASS. U. S. 1,651,581. Dec. 6, 1927. Wilbur F. Brown, Toledo, O., assignor to the Libbey-Owens Sheet Glass Co. Filed 5/3/26. As a new article of manufacture, a sheet of laminated glass, including a sheet of glass having a skin of cellulose formate thereon which has been coated with a film of vegetable oil.

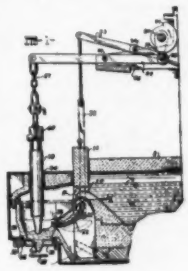
LAMINATED GLASS. U. S. 1,656,691. Jan. 17, 1928. Wilbur F. Brown, Toledo, O., assignor to the Libbey-Owens Sheet Glass Co. Filed 6/28/26. As a new article of manufacture, a sheet of laminated glass, comprising two sheets of glass, a skin of cellulose composition material, on one side each of both of said sheets of glass, a film of Canada balsam on both skins, and a sheet of non-brittle material between each of said films of Canada balsam.

GAS PRODUCER. U. S. 1,655,320. Jan. 3, 1928. Charles W. Lummis, Worcester, Mass., assignor to Morgan Construction Co. Filed 7/10/19. In a gas producer, a fuel shell, a bottom secured to said shell and constituting a support of the bed of ash and fuel contained in said shell, said bottom having an opening substantially in the center thereof, means for maintaining a depth of water upon said bottom around said central opening, and means for procuring the removal of ashes from the interior to the exterior of the producer through said central opening of said bottom.



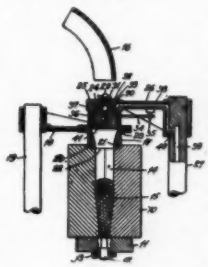
LAMINATED GLASS. U. S. 1,655,933. Jan. 10, 1928. Horace E. Allen, Toledo, O., assignor to the Libbey-Owens Sheet Glass Co. Filed 6/26/26. As a new article of manufacture, a sheet of laminated glass comprising a sheet of glass, a skin thereon, a film of tetralin, and a sheet of non-brittle material.

GLASS FEEDER. U. S. 1,653,478. Dec. 20, 1927. Leonard D. Soubier, Toledo, O., assignor to the Owens Bottle Co. Filed 4/14/23. A stationary discharging receptacle having an outlet orifice, and a transfer receptacle between said container and discharging receptacle, said container having an outlet through which molten glass issues in a continuous stream into said transfer receptacle, a power element, and means automatically operated thereby for periodically actuating the transfer receptacle to discharge the glass into said discharging receptacle. The flow of glass through outlet is regulated and controlled by a vertically reciprocating plunger.



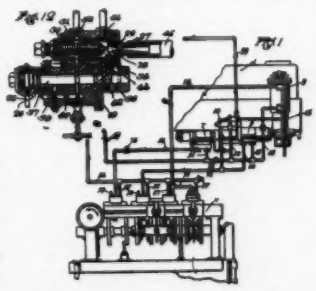
ANNEALING LEHR. U. S. 1,655,935. Jan. 10, 1928. James C. Blair, Toledo, O., assignor to the Libbey-Owens Sheet Glass Co. Filed 1/13/26. In sheet glass apparatus, an annealing lehr, means for supporting a sheet therein, a plurality of baffles arranged above the sheet and being progressively shorter from the hot end of the lehr toward the cold end thereof and a plurality of burners arranged within the lehr beneath said sheet.

GLASS-BLOWING MACHINERY. U. S. 1,654,731. Jan. 3, 1928. Henry W. Ingle, Hartford, Conn., assignor to Hartford-Empire Co. Filed 3/11/25. A mechanism for applying settle-blowing pressure immediately following the introduction of a mold charge into the mold through the funnel, by bringing a blow head into operative relation to the previously positioned funnel and applying blowing pressure therethrough. The application of settle-blowing pressure through the funnel reduces, by the time otherwise required for removing the funnel, the interval of time between the mold-charging and settle-blowing operations.



COOLER FOR SHEET GLASS APPARATUS. U. S. 1,656,103. Jan. 10, 1928. John L. Drake, Toledo, O., assignor to the Libbey-Owens Sheet Glass Co. Filed 3/2/27. A cooler adapted for use in sheet glass apparatus, comprising a hollow metallic casing, and an asbestos covering for said casing.

TIMING MECHANISM FOR GLASS-FEEDING APPARATUS. U. S. 1,654,710. Jan. 3, 1928. Oliver M. Tucker and William A. Reeves, Columbus, O., assignors, by mesne assignments, to Hartford-Empire Co. Filed 9/16/16. Timing mechanism for glass-feeding apparatus comprising valve mechanism for controlling the introduction and exhaust of fluid to the operating units of the glass feeding mechanism, a plurality of cam plates provided with apertures determinately spaced around the edges thereof and cam elements designed to removably fit in any one of said apertures.



GLASS APPARATUS AND LIP TILE THEREFOR. U. S. 1,655,992. Enoch T. Ferngren, Toledo, O., assignor to the Libbey-Owens Sheet Glass Co. Filed 3/14/25. In sheet glass apparatus, means for drawing a sheet from a mass of molten glass, and a tile arranged above the glass, the center portion thereof being relatively closer to the glass than the sides to permit a greater volume of heat above the side portions of the glass than in the center.

MACHINE FOR MAKING QUARTZ-GLASS RODS AND TUBES. U. S. 1,655,846. Jan. 10, 1928. Robert F. Schaller, Rahway, N. J., and William J. Lidle, Newark, N. J. Filed 2/20/26.

# The Glass World and What It Is Doing

**News of the Industry**

## Cast Tank Blocks Now Available

Corhart Refractories Company (Corning Glass Works and Hartford-Empire Company), Louisville, Ky., has announced the completion of its manufacturing plant at Louisville and that orders are being accepted for April delivery of Corhart cast refractory blocks. The statement says that the striking performance of these new blocks in glass-melting furnaces has created so tremendous an interest throughout the glass industry that careful planning and organization will be necessary if production is to take care of the initial demand.

AFTER ELEVEN MONTHS' RUN IN TANK

The illustration shows a panel of Corhart blocks after an eleven months' run in a lime glass tank in a large midwest factory. The remarkable resistance of these blocks to the corrosive action of the glass during the run has caused this manufacturer to order 100 tons of the new blocks for use in the construction of a complete tank furnace.

The general offices of the company, which have been located at 1306 Starks Building, Louisville, have been moved to the factory at 16th and Lee Streets.

## Building Construction Statistics

The 1927 construction volume was the second highest in the history of the country, according to F. W. Dodge Corporation. Contracts let on new building and engineering work in the 37 states east of the Rocky Mountains during the past year reached a total of $6,303,055,100, which was a drop of only 1 per cent from the record total of 1926 and an increase of 5 per cent over the total for the year 1925. For the entire country the total 1927 construction volume was estimated at a little over $6,800,000,000, being a loss of 3 per cent from 1926.

There was $477,363,800 worth of new construction started in December in these 37 States, which was a gain of 3 per cent over the total for the preceding month and a drop of 11 per cent from the total for December, 1926.

## The Glass Container Meeting at Washington

Judge Jennings of the Glass Container Association announces that the meeting of the glass men at the Mayflower Hotel at Washington, D. C., February 2 and 3, promises to be an extraordinary one and that plans are progressing smoothly to that end. He remarks:

"The program will be good, but the opportunity to discuss matters of business import will mean much more to those who attend than any type of entertainment we can offer you. However, we have every reason to feel that the program will be unusual."

It is practically assured that the Secretary of Commerce, Herbert Hoover, will address the meeting. It is pointed out that he will be the most important personage who has ever addressed a Glass Container Association meeting. His growing popularity among business men, in view of the political situation, will make his appearance more than ordinarily interesting to men of all parties.

President Frank F. Ferguson will open the Meeting at 10 a.m. Thursday, February 2, and will be followed by Dr. K. F. Meyer of the Hooper Foundation of the University of California who is coming all the way from the Pacific Coast to address the members. Dr. Meyer is quoted as being the outstanding bacteriologist of the United States and the biggest scientific man in America on the matter of food packing. He will not only speak but will be present prior to the meeting for consultation and advice.

The report of Traffic Director J. C. Magness will be heard and discussed by members.

In the afternoon at 2 o'clock J. S. Algeo will present the Statistical Committee's report, and the following addresses will be heard:

"Contingencies in Glass House Costs," by E. G. Ackerman.

"Operating to Statistics," Fred J. Rummel.

"The Business Outlook," George Roth, Harvard University Committee on Economic Research.

"The Economic Effect of Taking Business At or Below Normal Cost," C. R. Stevenson, Stevenson, Harrison & Jordon, President of the National Assn. of Cost Accountants.

Thursday evening at 7 o'clock the Members' Dinner will be held at the Mayflower Hotel.

On Friday morning, February 3, after the opening of the meeting by the President, the members will hear W. K. Brownlee, president of the Buckeye Clay Pot Company, Toledo, Ohio, on "Glass and Clay," and Lt. Governor F. Harold Van Orman of Indiana will speak.

Friday afternoon, commencing at 2 o'clock, addresses will be given by Jerry McQuade, vice-president Topics Publishing Company, on "Battling Some Drug Trade Business Bromides," and by Howard W. Dickson, former vice-president and general manager of George W. Batten Co., Inc. I. R. Stewart, chairman of the publicity committee will make a statement of the publicity situation.

## Building Forecast for Current Year

*The Architectural Forum*, whose annual forecasts of building construction for several years past have proved to be conservative, recently issued their estimate for expenditures for new buildings in 1928, showing a total, including buildings not designed by architects, of $6,505,128,000.

The *Forum's* survey, on which this forecast is based, is carried out in exactly the same manner as used for the last seven years. The figures indicate that building will continue in 1928 at least in the same volume if not reaching even greater totals than in 1927. The showing made by the survey is not in agreement with the widespread idea that the volume of building during the current year will be decreased. The *Forum* sees no reason why this should be the case unless general business conditions should become adversely affected by some new development that would shake the confidence of the public.

Attention is called to the increase of population by many millions during the past ten years. Obsolescence, replacements, fire loss,

affect the total amount of construction. Better standards of living also have their effect. It is predicted, therefore, that building activity during the year 1928 will approximately equal that of 1927 and that for the next few years there will be no general collapse of the situation but rather a gradual return to a new normal on a higher level than that established in any previous decade.

### Glass Substitute

A group of bankers is reported in the New York *Journal of Commerce* to have acquired a substantial interest in the Acetol Products, Inc., and that securities would be out on the market shortly. This company's principal product is Cel-O-Glass. This product is, for all practical purposes, an unbreakable material made by coating tough wire mesh with a substance that admits practically as much daylight as ordinary glass, but has the added feature that it also admits part of the ultra-violet rays of the sun. The company's growth since its establishment four years ago is indicated by the fact that sales during the first year were less than 1,500,000 square feet, these sales having mounted in each succeeding year until the management estimates production and sales of approximately 30,000,000 square feet for this year.

### Car Requirements for Glass Containers in 1928

At the fourth annual meeting of the Atlantic States Shippers Advisory Board, held at the Commodore Hotel, New York, January 5, J. C. Magness, chairman of the Glass Container Committee, reported that car requirements for the first quarter of 1928 had been estimated at 2,675 cars, which is about 5 per cent greater than either the preceding quarter or the first quarter of 1927. A fair volume of business is expected and transportation conditions are good. E. S. Thorpe of the Whitall Tatum Company, Philadelphia, Pa., is vice-chairman of the committee.

### Plate Glass Production in 1927

Figures compiled by P. A. Hughes, secretary of the Plate Glass Manufacturers of America, show that the production of polished plate glass for the month of December, 1927, was 7,446,285 sq. ft. as compared with 7,344,361 sq. ft. produced in December, 1926.

The total production for the last quarter of 1927 was 24,722,243 sq. ft., making the total for the year 111,390,933 sq. ft. as compared with 128,857,875 sq. ft. produced in 1926.

### British Industries Fair

This fair, which is under the auspices of the Department of Overseas Trade, will be held simultaneously in London and Birmingham, February 20 to March 2. According to the British Consulate General in New York, a large number of American business firms will be represented. Glass and Glassware have always been featured at this exhibition and a new scientific, photographic and optical exhibit has been added. A special feature of the fair is that products can be exhibited only by their actual manufacturers.

### Mirror Trade Barometer

Seven members of the National Association of Manufacturers reported to Harry C. Sorden, secretary, having silvered during December, 1927, a total of 124,100 sq. ft. of glass; December, 1926, 149,135 sq. ft., and during the year 1927, 1,566,446 sq. ft., compared with 1926, 1,841,589 sq. ft.

From the association's compilation, there were 16,760,972 sq. ft of glass silvered during 1927 and 19,705,002 sq. ft. silvered during 1926. Mr. Sorden asks the members to keep their records during 1928 so that they can furnish similar data, making this barometer more valuable to them.

### Capt. Brown Had Serious Attack

A statement to THE GLASS INDUSTRY concerning the condition of Captain Charles W. Brown, president of the Pittsburgh Plate Glass Company, who was afflicted with a paralytic stroke at his home on Saturday, January 14, is to the effect that he has survived the critical period and up to the time of going to press January 27, showed encouraging signs of recovery. The news of his sudden illness caused great concern and has aroused the sympathy of the whole trade.

### New Feldspar Mill Projected

An organization of North Carolina and New York interests is reported to have arranged for the construction of a feldspar milling and grinding plant at Bowditch, near Burnsville, N. C. It is said that operations will begin about the middle of this year. Some of those interested in the project are: Judge C. B. Hyatt, Asheville, N. C., State Senator James L. Hyatt, Burnsville, S. C., and J. F. Shinn, Norwood, N. C.

## Trade Activities

**Pittsburgh Safety Glass Company** has been incorporated at Wilmington, Del., (Charles Copeland), with a capital stock of $1,000,000.

**The Wellman-Seaver-Morgan Company**, Cleveland, O., announce the removal of their New York office to 30 Church Street, where they are now located.

**The Hazel-Atlas Glass Company,** Wheeling, W. Va., has been allowed an appeal by the Supreme Court of West Virginia from the lower court decision awarding $300,000 in royalties to Charles E. Blue.

**The Obear-Nester Glass Company** have moved their office from 2nd and Chestnut Streets, St. Louis, Mo., to a new general office building located at their factory, Broadway and 20th Streets, East St. Louis, Ill.

**West Coast Glass and Tile Company,** 1440 East Adams Street, Los Angeles, Cal., has been incorporated in Maine with an authorized capital of $150,000. The construction of a plant in California is planned.

**Eclipse Dial & Glass Company,** Thomaston, Conn., announce that in addition to other products they can furnish convex and odd shape formed glass in sizes up to 10" and are prepared to do printing and fusing in vitrifiable colors on glass articles for advertising purposes.

**The Fostoria Glass Company,** according to local reports, has let a contract for the installation of a new furnace at the Moundsville plant. It is said that this will increase the furnaces from four to five and will increase the production capacity of the plant 30 to 35 per cent.

**The Nurre Mirror Plate Company,** Bloomington, Ind., have changed the name of their organization to The Nurre Companies. The general offices and plants 1 and 2 are located in Bloomington. Plant 3, at Burlington, Iowa; plant 4 at St. Louis, Mo.; plant 5 at Kansas City, Mo., and plant 6 at Memphis, Tenn.

**The Pittsburgh Annual Exhibit of the Associated Glass** and Pottery Manufacturers, held from January 9 to 21, resulted in an interesting display of glassware, colored glass again predominating and a number of new designs being in evidence. The exhibits were located principally at the Fort Pitt and William Penn Hotels. Keen interest on the part of buyers was manifested and considerable business was placed.

**The Amtorg Trading Corporation,** 165 Broadway, New York, through J. P. Nikonow, confirm the report that a new Fourcault plant is being built in Russia, machinery for which is to be purchased in Europe. The Russians are already successfully operating two large Fourcault plants and are also considering the building of a bottle-making plant, machinery for which will be purchased in the United States. Plans for its erection, however, are still indefinite.

**The American Bottle Company,** Toledo, O., is distributing to the bottle trade a glass portrait bust about 5 inches in height of the late Michael J. Owens, who invented the first successful automatic machine for the production of narrow neck bottles and whose later inventions, they point out, have produced bottles which are so uniform that time and labor-saving machinery for the filling, crowning and labeling of bottles became possible to an extent not heretofore known.

**General Electric Company** announces the creation of a motor division of its industrial department, through E. O. Shreve, manager of the department involved. The new division will have general supervision of all policies, prices, etc., concerning all motors handled by the General Electric Industrial Department. F. M. Kimball has been appointed advisory manager, and J. E. N. Hume, manager, of the division in question, both appointments becoming effective January 1, 1928.

**The Society of Glass Technology, England,** will hold its annual election of officers at the eleventh annual meeting on April 18. President Walter Butterworth, Sr., has been renominated for the coming year. Other officers nominated are: Vice-presidents, B. P. Dudding and Edward Meigh. Joseph Connolly as general treasurer, F. C. Flint as American treasurer and Professor W. E. S. Turner, honorary secretary, have all been renominated.

*The West Virginia Review,* Charleston, W. Va., in its December issue published a description of the Fostoria Glass Company's plant at Moundsville, W. Va., with illustrations and portraits of W. A. B. Dalzell, president, and C. B. Roe, vice-president and secretary. The article describes the various manufacturing and decorating operations through which Fostoria glassware goes during production processes.

**The Mississippi Glass Company,** St. Louis, Mo., have announced that while their subsidiary, the Walsh Fire Clay Products Company, recently sold its central Missouri refractory plants to the Harbison-Walker Refractories Company, by whom they will be operated, the St. Louis plants remain in possession of the Glass Refractories Division of the Mississippi Glass Company, and will be operated by the original organization. Regular production of refractory materials for glass manufacturers and the manufacture of special shapes is being continued.

**The Turner Glass Company,** Terre Haute, Ind., have filed notice of the removal of their principal office from Terre Haute, to 1349 Consolidated Building, Indianapolis, Ind. It is reported that a mortgage for $1,200,000 on the real and personal property of the corporation has been given to the National City Bank of Chicago and Arthur J. Baer, co-trustee. The funds from the mortgage are to be used for refunding certain existing indebtedness, furnishing additional working capital and other corporation purposes. The report states that an interchange of stock amounting to 5,000 shares of second preferred of $100 par value, drawing 6 per cent interest, has been arranged with the Woodbury Glass Company, Winchester, Ind. Also 200 shares of common stock are to be transferred to the Woodbury Company. The company recently filed papers increasing its capital stock from 120,000 shares no par value common and $125,000 preferred, to 120,000 shares no par value common and $625,000 preferred.

## What Our Advertisers Are Doing

**The Miller Machine & Mold Works,** 705 Ann St., Columbus, O., on January 19 shipped to Pine Glass Corporation, Okmulgee, Okla., machinery and molds weighing 36,880 pounds. The shipment consisted of: three model "J-P" 10 mold motor driven fruit jar machines, one model "T-L" 10 mold tumbler pressing machine and one model "C" 12 mold glass cap machine.

**The Amsler-Morton Company,** Pittsburgh, Pa., recently received contracts for a large recuperative tank furnace to be erected for the Hocking Glass Company, Lancaster, three more for Indiana Glass Company, Dunkirk, Ind., one for Carr-Lowrey Glass Company, Baltimore, Md., one for Highland Glass Company, Washington, Pa., and two for Southern Glass Company, Los Angeles, Cal. Most of these furnaces, they state, will furnish glass to a single feeder machine and lehr, each a complete independent production unit, such, they state, as will constitute the major portion of the industry in the near future. Glass making by this method permits color changes such as green, pink, amber, blue, etc. In the production of crystal glass, control of seed and color is an important asset. The increased income from capital investment by distribution into smaller units, with a reduction of loss of production occasioned by repairs, less labor turnover, less warehousing of finished material due to production elasticity, will, they assert, assure maximum manufacturing efficiency.

The company reports that the Amco portable unit lehr is finding a ready market, also that they have received a repeat order for a second Amco "hand" type lehr, the widest continuous type offered to the industry, using the woven wire conveyor and alloy heating elements, from the Carr-Lowrey Glass Company, Baltimore, Md., after nine months of continuous operation of the first one. This is an 80x70 ft. lehr, suitable for ware requiring "peanut roasters" or ware assembling ovens, tableware and large lighting goods.

A full mechanical gas producer plant is being designed for Brockway Machine Bottle Company, Brockway, Pa., and erection will start soon to round out this company's program of new tanks, lehrs, buildings and complementary equipment which has been in process of construction for the past six months.

The company report that they have several new forms of lehrs and glass melting furnaces in process of development which will be offered during 1928.

**The Pennsylvania Salt Manufacturing Company's** organization and personnel is outlined from its inception in 1850 to 1928, in the second printing of a little booklet issued January 1 from the company's main office at Philadelphia, Pa. The present directors and officers under Miers Busch, president, are listed and the names of the incorporators and past presidents, vice-presidents, secretaries, treasurers, and directors are given. Information is given regarding the charter and capital stock which, in 1850 amounted to $100,000 and which has since been increased to $7,500,000. Dividends ranging from 8 to 12 per cent annually have been paid by the company and also two extra dividends of one per cent each. The booklet lists eight subsidiary companies in which it owns all of the capital, including, water supply companies, light and power, coal and chemical concerns, also a list of many of the chemical products manufactured at the present time by the company including salt cake and aluminum hydrate. The company is the exclusive importer of Greenland "Kryolith." The following changes in the executive organization of the company were made on January 1. N. Emory Bartlett, who has been with the company since November, 1893, has been elected a vice-president, and will also continue his duties as general sales agent. Y. F. Hardcastle, who has been connected with the Wyandotte, Mich. plant since January, 1910, has also been elected a vice-president.

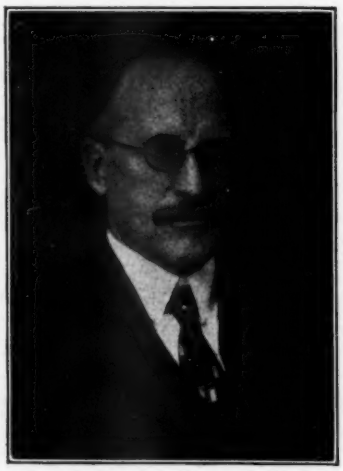
## Personals

**Carl D. Smith,** formerly fuel engineer for the Simplex Engineering Company, Washington, Pa., is now with the Imperial Glass Company, Bellaire, O.

**Karl B. Weaver,** assistant superintendent of the Hazel-Atlas Glass Company's plant No. 2 at Zanesville, O., is reported to have been appointed superintendent of the Company's plant at Ada, Okla.

**Walter H. Wiseman,** formerly sales manager of the opal department of the Monongah Glass Company, Fairmont, W. Va., has resigned from that company to become general sales manager of the American Metal Cap Company, Brooklyn, N. Y., succeeding P. C. Doyle. Mr. Wiseman has already moved to New York to take up his new duties.

**Victor Windett,** who since 1917 has been engineer of the Gas Producer Division of the Wellman-Seaver-Morgan Company, Cleveland, Ohio, has been appointed manager of the Division, effective January 1, 1928.



VICTOR WINDETT

Mr. Windett is a graduate of the Massachusetts Institute of Technology in mechanical engineering. Following his college course he became connected with the Illinois Steel Co., Chicago, and later with Julian Kennedy, the prominent engineer. He was resident engineer of the American Coke & Gas Construction Company in the building of the Otto Hoffman coke oven plant at Maysville, Wis. He spent some time as engineer and contractor at New Orleans and in Louisiana on drainage, water, sewerage and levee construction work, and in the Chicago district on various public work, harbor work and bridge work, and on the 4th U. S. Lock at Ste. Saulte Ste. Marie, Mich.

During the World War he supervised the building of open hearth furnaces at the Watertown, Mass., arsenal for the Wellman-Seaver-Morgan Company, and sulphuric acid plants at Cuba City and at New Diggings, Wis., for the Leonard Construction Company of Chicago.

**H. F. Arnold,** formerly superintendent of the Winslow Glass Company, is now assistant general manager of the Atlantic Bottle Company, Tarentum, Pa.

**J. F. Wischhusen,** president of the Superfos Company since its foundation in 1920, has become associated with the Harshaw Fuller & Goodwin Co., Cleveland, O., and joined their New York office at 150 Nassau Street, New York. The Superfos Company, Inc., has moved its offices to the same address and for the time being will do business from that address in an unchanged manner.

**Professor Alexander Silverman,** head of the Department of Chemistry of the University of Pittsburgh, was tendered a dinner by the students and faculty of Bryn Mawr College in Rockefeller Hall on January 12. Following the dinner he delivered an illustrated lecture on "Glass: One of Man's Blessings." The Science Club of Bryn Mawr held a reception for Professor Silverman after the lecture.

**Frank W. Preston,** consulting engineer, of Leicester, England, and Butler, Pa., widely known through his published papers on scientific and technical subjects, recently left the Standard Plate Glass Company with which he has been connected for some time and may now be addressed at 602 Butler County National Bank Building, Butler, Pa. Part I of an article by Mr. Preston discussing, as far as possible in non-technical terms, the principles of design of plate glass polishing machines, appears in this issue.

## Recent Deaths

**John Herzog**

John Herzog, senior member of John Herzog & Company, Forest, O., died December 16, 1927. He was one of the early producers of high grade lime for glass making purposes. His son, Burt Herzog, has succeeded him in the management of the business.

## Coming Meetings

**The Glass Container Association** will hold its next meeting at the Mayflower Hotel, Washington, D. C., February 2 and 3.

**The American Ceramic Society's** annual meeting will be held at the Ambassador Hotel, Atlantic City, N. J., February 5 to 11, 1928. This will be a joint meeting of the National Brick Manufacturers Association and Heavy Clay Products Division. The European tour of the Society will cover the period from May 19 to July 5, 1928, and will include visits to England, Germany, Czechoslovakia, France, Holland.

**The Eastern Division of the National Glass Distributors' Association** will hold its first meeting of 1928 at the Hotel McAlpin, New York City, February 16. Secretary Carl F. Doerr announces that this meeting will be one of the most important ever held and suggests that all members attend. A detailed notice will be mailed to all members previous to the meeting.

## Inquiries Received

*For further information address* THE GLASS INDUSTRY

397 (from London). We would like to get in touch with a firm which is in a position to enter into business relations with us and supply opal glassware for shipment to England (Dec. 30).

398. Can you give us the names of a few pressed glassware manufacturers? (Jan. 11).

399. We are desirous of obtaining glass test tubes (Jan. 11).

400. Can you tell us where we can obtain small hollow glass balls, about 4 in. in diameter, made in colored glass? (Jan 10).

401. We should like to obtain the names of concerns making glass paper weights and other glass advertising novelties (Jan. 2).

402. We find it necessary to drill a number of 1/16-inch holes through photo thickness glass. Can you give us any information as to what material is necessary and also at what speed the drilling should be done? (Jan. 12.)

403. We are interested in the ultraviolet ray glass for use in the construction of new homes in our territory and if you can refer this inquiry to some glass manufacturer who can furnish same, we would appreciate it. We were referred to you by the U. S. Department of Commerce, San Francisco, Cal. (Jan. 20).

## What the World Wants

*Specific Inquiries for American Goods, Received in the Department of Commerce, Washington, D. C.*

Germany. 29065, medicine bottles.
Italy. 29068, art and ornamental glass.
India. 29089, glass, crockery and earthenware.
New Zealand. 28895, glass jars, 2, 4, 8 and 16 ounce bottles.

## Glass Stock Quotations

PITTSBURGH STOCK EXCHANGE, JANUARY 20, 1928

Reported by Moore, Leonard & Lynch, Union Trust Bldg., Pittsburgh, Pa.

| | Bid | Asked | Last |
|---|---|---|---|
| American Window Glass Machine, com.... | 16 | 20 | 17 |
| American Window Glass Machine, pfd..... | 35 | .. | 35 |
| American Window Glass, pfd..... | 84½ | .. | 85 |
| United States Glass..... | 15 | .. | 15 |
| Pitsburgh Plate Glass, com..... | .. | .. | 213 |
| Standard Plate Glass, com..... | 3 | 4 | 2⅜ |
| Standard Plate Glass: | | | |
| Preferred cumulative..... | .. | .. | 12 |
| Prior preferred..... | 20½ | .. | 25 |

TOLEDO, O., JANUARY 20, 1928

| | Bid | Asked | Last |
|---|---|---|---|
| Owens Bottle, pfd..... | 112 | 114 | 112 |
| Libbey-Owens Sheet Glass, com..... | 120 | 125 | 123 |
| Libbey-Owens Sheet Glass, pfd..... | 115½ | 117½ | 116½ |

WHEELING STOCK EXCHANGE, JANUARY 20, 1928

| | Bid | Asked | Last |
|---|---|---|---|
| Hazel-Atlas ..... | 73 | 74 | 73¼ |
| Imperial ..... | .. | .. | 72 |
| Fostoria ..... | 208 | .. | 208 |
| Central ..... | .. | .. | 75 |
| Jefferson, pfd..... | .. | .. | 96 |

## READERS WANTS AND OFFERS

**GLASSMAKER**—Superintendent open for position. Familiar with all factory conditions. Will guarantee good glass—flint, green and amber. Used to all kinds of fuel. Will give reference if required. Address A-302, care of THE GLASS INDUSTRY, 50 Church Street, New York.

**SALESMAN WANTED**—A man familiar with the glass manufacturing business, capable of selling a product of extraordinary merit. Address S-1, care THE GLASS INDUSTRY, 50 Church Street, New York.

**SALESMAN**—Experienced, Eastern representative for glass manufacturer. Acquaintance with architects. Salary. Christian firm. Address, S-2, care The GLASS INDUSTRY, 50 Church Street, New York.

**FOR SALE**—One, William Miller, model "P. C.", eight (8) mold milk bottle machine. This machine was used only 2½ years on heavy bottles. The cages are all new; the machine is in good operating condition. This machine can be bought at a very fair price. Further particulars may be obtained by corresponding with the BUCK GLASS COMPANY of Baltimore, Md.

**For Sale:** CULLET of all Descriptions
Free from Caps, Wires, etc.
GEORGE F. BAUMANN, Dealer,
1110 Carroll Street, Brooklyn, New York.
Carloads Ready for Immediate Shipment.

## Current Prices of Glass-Making Materials

January 20, 1928

Quotations furnished by various producers, manufacturers and dealers

| | | Carlots | Less Carlots |
|---|---|---|---|
| **Acid** | | | |
| Citric (dom.) | lb. | .44½ | .44½ |
| Hydrochloric (HCl) 20° tanks, per 100 lb. | lb. | .. | 1.10 |
| Hydrofluoric (HF) 60% (lead carboy) | lb. | .. | .13½ |
| 52% and 48% | lb. | .10 | .10-.11½ |
| Nitric ($HNO_3$) 38° carboy ext. Per 100 lb. | lb. | 5.50 | 5.75 |
| Sulphuric ($H_2SO_4$) 66° tank cars | ton | 15.50 | .. |
| Tartaric | lb. | .35 | .35 |
| Alcohol, denatured | gal. | .. | .48½ |
| Aluminum hydrate ($Al(OH)_3$) | lb. | .04½-.05 | .05½-.06 |
| Aluminum oxide ($Al_2O_3$) | lb. | .c | .07 |
| Ammonium bifluoride ($NH_4$) FHF | lb. | .. | .20 |
| Ammonia water ($NH_4OH$) 26° drums | lb. | .03 | .03¼ |
| Antimony, metallic (Sb) | lb. | .. | .10¾-.11 |
| Antimony oxide ($Sb_2O_3$) | lb. | .. | .14-.16 |
| Antimony sulphide ($Sb_2S_3$) | lb. | .15 | .16 |
| Arsenic trioxide ($As_2O_3$) (dense white), 99% | lb. | .04 | .04¼-.04½ |
| Barium carbonate ($BaCO_3$) | | | |
| Precipitated | ton | 53.00 | 58.00 |
| Natural, powdered, imported | ton | 48.00 | 50.00 |
| Barium hydrate ($Ba(OH)_2$) | lb. | .. | .. |
| Barium nitrate ($Ba(NO_3)_2$) | lb. | .08¼ | .08½ |
| Barium selenite ($BaSeO_3$) | lb. | .. | .. |
| Bone ash | lb. | .05 | .05½ |
| Borax ($Na_2B_4O_710H_2O$) | lb. | .03¾ | .04-.04½ |
| Boric acid ($H_3BO_3$) | lb. | .08-.08¼ | .08¼-.09 |
| Refined | lb. | .08-.08¼ | .08½-.08¾ |
| Cadmium sulphide (CdS)— | | | |
| Red | lb. | .. | 1.20 |
| Orange | lb. | .. | 1.10-1.25 |
| Yellow | lb. | .. | 1.20-1.40 |
| Chromium oxide ($Cr_2O_3$) | lb. | .27 | .28 |
| Cobalt oxide ($Co_3O_4$) | | | |
| In bbls. | lb. | .. | 2.10 |
| In 10 lb. tins | lb. | .. | 2.20 |
| Copper oxide | | | |
| Red ($Cu_2O$) | lb. | .. | .30 |
| Black (CuO) | lb. | .. | .25-.30 |
| Black prepared | lb. | . | .30 |
| Cryolite ($Na_3Al\ F_6$) Natural Greenland Kryolith) | lb. | .09 | .10-.10½ |
| Artificial or Chemical | lb. | | .09½ |
| Epsom salts ($MgSO_4$) (imported) Per 100 lb. | | .. | 1.15-1.30 |
| Feldspar— | | | |
| 100 mesh | ton | 11.00-20.00 | 15.50-22.00 |
| 80 mesh | ton | .. | 14.50 |
| 40 mesh | ton | 12.50 | 13.50 |
| Fluorspar ($CaF_2$) domestic, ground, 95-98% (max $SiO_2$, 2½%) | | | |
| Bulk, carloads, f.o.b. mines | ton | 32.50 | .. |
| In bags or barrels | ton | 36.50 | 41.50 |
| Formaldehyde | lb. | .08½ | .09 |
| Graphite (C) | lb. | .. | .04-.07 |
| Iron oxide— | | | |
| Red ($Fe_2O_3$) | lb. | .. | .03¼-.07 |
| Black (FeO) | lb. | .03½ | .. |
| Kaolin (f.o.b. mine) | ton | 9.00 | .. |
| English, lump, f.o.b. New York | ton | 13.00-23.00 | .. |
| Kryolith (see Cryolite) | | | |
| Lead chromate ($PbCrO_4$) | lb. | .. | .. |
| Lead oxide ($Pb_3O_4$) (red lead) | lb. | .09-.10 | .10-.10¼ |
| Litharge (PbO) | lb. | .08-.09 | .09-.09¼ |
| **Lime—** | | | |
| Hydrated ($Ca(OH)_2$) (in paper sacks) | ton | 11.50-12.50 | .. |
| Burnt (CaO) ground, in bulk | ton | 9.00 | .. |
| Burnt, ground, in paper sacks | ton | 11.00 | .. |
| Burnt, ground, in 280 lb. bbls. | Per bbl. | 2.15 | 2.30 |
| Limestone ($CaCO_3$) | | 2.00 | .. |
| Magnesia (MgO)— | | | |
| Calcined, heavy (in bbls.) | lb. | .06 | .07 |
| light (in bbls.) | lb. | .. | .23 |
| extra light (in bbls.) | lb. | .. | .37 |
| Magnesium carbonate ($MgCO_3$) | lb. | .06 | .07½-.08 |
| Manganese 85% ($MnO_2$) | lb. | .04 | .04½ |
| Nickel oxide ($Ni_2O_3$), black— | | | |
| for nickel content | lb. | .. | .35 |
| Nickel monoxide (NiO), green— | | | |
| for nickel content | lb. | .. | .35 |
| Plaster of Paris, bags | ton | .. | 23.00 |
| Potassium bichromate ($K_2Cr_2O_7$)— | | | |
| Crystals | lb. | .08¼ | .08½ |
| Ground | lb. | .11 | .12 |
| Potassium carbonate— | | | |
| Calcined ($K_2CO_3$) 96-98% | lb. | .06⅝ | .07⅛ |
| Hydrated 80-85% | lb. | .06 | .06½ |
| Potassium chromate ($K_2CrO_4$) | lb. | .. | .28 |
| Potassium hydrate (KOH) (caustic potash) | lb. | .07⅛ | .08 |
| Potassium nitrate ($KNO_3$) (gran.) | lb. | .. | .05⅞-.06 |
| Potassium permanganate ($KMnO_4$) | lb. | .15 | .15½ |
| Powdered blue | lb. | .. | .24-.26 |
| Rochelle salts, bbls. | lb. | .. | .23 |
| Rouge | lb. | .. | .. |
| Rutile ($TiO_2$) powdered, 95% | lb. | .15-.20 | .20-.25 |
| Salt cake, glassmakers ($Na_2SO_4$) | ton | 22.00 | .. |
| Selenium (Se) | lb. | .. | 2.10-2.15 |
| Silver nitrate ($AgNO_3$) | oz. | .. | .39⅞-.41⅞ |
| Soda ash ($Na_2CO_3$) dense, 58%— | | | |
| Bulk, on contract | Flat per 100 lb. | 1.22½ | .. |
| In barrels | Per 100 lb. | 1.55-1.57½ | 2.40 |
| In bags | Per 100 lb. | 1.37½-1.40 | .. |
| Spot orders..02½-.05 per 100 lbs. higher | | | |
| Sodium bichromate ($Na_2Cr_2O_7$) | lb. | .06¼ | .06⅜ |
| Sodium hydrate (NaOH) (caustic soda) | Per 100 lb. | 3.35 | .. |
| Sodium nitrate ($NaNO_3$)— | | | |
| Refined (gran.) in bbls. | lb. | .03⅞ | .04½ |
| 95 per cent | Per 100 lb. | 2.35 | 2.75 |
| Sodium selenite ($Na_2SeO_3$) | lb. | .. | 2.35 |
| Sodium fluosilicate ($Na_2SiF_6$) | lb. | .04½ | .05 |
| Sodium uranate ($Na_2UO_4$) Yellow or Orange | lb. | .. | 1.25 |
| Sulphur (S)— | | | |
| Flowers, in bbls. | Per 100 lb. | 3.45 | 3.80-4.00 |
| Flowers, in bags | Per 100 lb. | 3.10 | 3.45-3.65 |
| Flour, heavy in bbls. | Per 100 lb. | 2.85 | 3.20-3.40 |
| Tin chloride ($SnCl_2$) (crystals) | lb. | .41 | .41½ |
| Tin oxide ($SnO_2$) in bbls. | lb. | .62 | .63 |
| Uranium oxide ($UO_3$) (black, 96% $U_3O_8$) | | | |
| 100 lb. lots | lb. | .. | 1.25-2.25 |
| Zinc oxide (ZnO) | lb. | .06½ | .07 |
| Zircon | | | |
| Granular (Milled .005-.02c higher) | | .07 | .07½-.08 |
| Crude, Gran. (Milled .005-.02c higher) | | .03½ | .04-.05 |

## Monthly Summary of United States Foreign Commerce in Glass

### EXPORTS

**Corrected to December 27, 1927**

| | November 1926 Quantity | November 1926 Value | November 1927 Quantity | November 1927 Value | Eleven Months Ending November 1926 Quantity | Eleven Months Ending November 1926 Value | Eleven Months Ending November 1927 Quantity | Eleven Months Ending November 1927 Value |
|---|---|---|---|---|---|---|---|---|
| **Glass and glass products (total)** | ..... | $838,292 | ..... | $743,816 | ..... | $8,451,150 | ..... | $8,141,523 |
| Plate and window glass— | | | | | | | | |
| Window glass, common, box 50 sq. ft. | 2,650 | 12,612 | 1,269 | 8,770 | 28,791 | 167,105 | 20,492 | 113,000 |
| Plate glass, unsilvered, sq. ft. | 28,274 | 13,752 | 108,163 | 27,762 | 818,896 | 230,911 | 982,443 | 307,378 |
| Other window and plate glass lbs. | 777,166 | 48,857 | 298,362 | 31,028 | 2,670,049 | 246,772 | 3,819,027 | 396,485 |
| Glass containers (bottles, vials and jars) | ..... | 251,720 | ..... | 204,165 | ..... | 2,906,778 | ..... | 2,823,204 |
| Table glassware, plain | ..... | 142,660 | ..... | 121,461 | ..... | 1,518,996 | ..... | 1,319,876 |
| Table and other glassware, cut or engraved | ..... | 14,677 | ..... | 12,445 | ..... | 161,992 | ..... | 129,265 |
| Lamp chimneys and lantern globes lbs. | 121,980 | 23,622 | 221,818 | 45,327 | 1,868,506 | 354,082 | 1,762,546 | 359,896 |
| Globes and shades for lighting fixtures lbs. | 132,938 | 46,966 | 159,667 | 60,855 | 1,600,243 | 537,652 | 1,527,906 | 560,936 |
| Chemical glassware lbs. | 23,003 | 21,296 | 18,531 | 18,992 | 207,657 | 188,944 | 196,546 | 177,431 |
| Electrical glassware, except for lighting lbs. | 373,191 | 53,897 | 212,766 | 26,291 | 4,659,130 | 449,075 | 2,118,757 | 222,122 |
| Other glassware | ..... | 208,233 | ..... | 186,720 | ..... | 1,688,843 | ..... | 1,731,930 |

### IMPORTS

**Corrected to December 27, 1927**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Glass and glass products | ..... | 1,593,862 | ..... | 1,505,233 | ..... | 19,156,665 | ..... | 15,663,096 |
| Cylinder, crown and sheet— | | | | | | | | |
| Unpolished dut. lb. | 7,129,657 | 245,606 | ..... | ..... | 73,712,506 | 2,906,534 | ..... | ..... |
| Weighing less than 80 pounds per case dut. lb. | ..... | ..... | 2,036,989 | 52,301 | ..... | ..... | 42,260,211 | 1,109,538 |
| Weighing 80 pounds or over per case dut. lb. | ..... | ..... | 1,747,411 | 103,757 | ..... | ..... | 34,774,942 | 1,514,021 |
| Bent, ground, beveled, colored, painted, etc., and polished dut. | ..... | 32,760 | ..... | 30,911 | ..... | 495,884 | ..... | 353,734 |
| Plate glass dut. sq. ft. | 1,744,690 | 620,820 | ..... | ..... | 24,324,098 | 8,084,576 | ..... | ..... |
| Polished, unsilvered dut. sq. ft. | ..... | ..... | 1,101,091 | 269,193 | ..... | ..... | 14,371,505 | 4,038,155 |
| Other dut. sq. ft. | ..... | ..... | 206,943 | 41,569 | ..... | ..... | 1,248,454 | 291,898 |
| Bottles, vials, jars, demijohns and carboys, molded or pressed dut. | ..... | 7,508 | ..... | 15,998 | ..... | 236,215 | ..... | 175,166 |
| Table and kitchen utensils dut. | ..... | 12,982 | ..... | 30,955 | ..... | 95,158 | ..... | 173,694 |
| Glassware, cut or decorated dut. | ..... | 293,739 | ..... | 357,520 | ..... | 2,697,960 | ..... | 3,460,444 |
| Blown glassware, n. e. s.— | | | | | | | | |
| Bottles, ornaments, gauge glasses and other n. e. s. dut. | ..... | 146,285 | ..... | 274,523 | ..... | 1,807,830 | ..... | 1,695,011 |
| Bulbs for electric lamps dut. No. | 1,480,315 | 17,181 | 1,561,681 | 22,156 | 17,327,728 | 195,646 | 13,656,326 | 143,563 |
| Chimneys, globes, shades, prisms and other illuminating glassware dut. | ..... | 94,164 | ..... | 126,087 | ..... | 921,000 | ..... | 891,864 |
| Articles and utensils for chemical, scientific, and experimental purposes dut. | ..... | 37,783 | ..... | 38,530 | ..... | 493,542 | ..... | 478,659 |
| Other glassware dut. | ..... | 85,034 | ..... | 141,733 | ..... | 1,222,320 | ..... | 1,337,349 |